Braddock Road Multimodal Study

County of Fairfax, Virginia

Final Report

RK&K

May 2018

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Attached: Appendix

Executive Summary

The Braddock Road Multimodal Study was undertaken by the Fairfax County Department of Transportation (FCDOT) to evaluate potential improvements along the corridor from Guinea Road to I-495 (the eastern improvement limit was extended to the Ravensworth Road intersection during the study). The potential improvements are focused to address the anticipated traffic congestion, due to increased vehicular demand, and improve bicycle and pedestrian access/safety along the corridor.

Braddock Road (Route 620) is classified as a Minor Arterial and generally travels in an east-west direction. It supports commercial, retail, institutional, commuter, and residential traffic. Within the study corridor Braddock Road intersects with numerous side streets that range from arterials to local/neighborhood streets. In the eastern section of the study area Braddock Road intersects with Interstate 495 (Capital Beltway), including direct north-serving access to the I-495 Express Lane facility. According to the Fairfax County Comprehensive Plan, the future improvements to Braddock Road include general purpose lane widening from the Guinea Road intersection to the Burke Lake Road intersection, and High-Occupancy Vehicles (HOV) lane widening from the Burke Lake Road intersection to the I-495 interchange.

This study was focused on various goals to improve both the vehicular traffic flow and bicycle/pedestrian safety. The study goals included:

- Analyze and recommend a plan to provide multimodal improvements on Braddock Road from Guinea Road to Ravensworth Road.
- Consider an array of options for road improvements
    - Intersection and Corridor Improvements
    - General Purpose Lanes Widening
    - HOV Lanes Widening (from the Fairfax County Comprehensive Plan)
- Evaluate the realignment of Danbury Forest Drive to create a four-legged intersection with Wakefield Chapel Road at Braddock Road (coincides with the recommendations from a previous study).
- Evaluate the commuter parking and potential transit center locations along the study corridor.
- Evaluate and determine bicycle and pedestrian facilities to be added or improved.
- Provide facilities that encourage transit use, carpooling and non-motorized travel.
- Evaluate project costs, environmental, permitting needs and right-of-way requirements
- Engage the community in the evaluation and solution.
    - Task Force Participation
    - Community Meetings
    - Small Citizen Groups

A citizen advisory group (Task Force) was appointed by Fairfax County via the Braddock District Supervisor's office to represent the communities contained within the study area. The Task Force met monthly (except for summer and winter breaks) with the study team (FCDOT and RK&K Team) and reviewed the current study progress and the next steps.

The responsibilities of the Task force included:

- Representing the communities' interests and to disseminate the studies progress throughout the community

- Assisting in the development of the roadway improvement alternatives and park-&-ride/transit center options
- Developing Measurements of Effectiveness (MOEs) for roadway improvement alternatives and park-&-ride/transit center options
- Examining and scoring each of the roadway improvement alternatives and park-&-ride/transit center options
- Providing a recommended roadway improvement alternative and park-&-ride/transit center option. (See Chapter 9 for Recommendations)

The main goal of the Braddock Road Multimodal Study included developing and evaluating various improvement options for the study corridor. The improvement alternatives studied include:

- No-Build
- Intersection and Corridor Improvements
- HOV Outside Lanes Widening
- HOV Inside Lanes Widening
- General Purpose Lanes Widening

All improvement alternatives included the following bicycle and pedestrian improvements to the study corridor:

- A new Shared-use Path along both Eastbound and Westbound of Braddock Road
- New sidewalks
- Viable bicycle/pedestrian overpass (bridge) locations
- Improvements to the existing underpass at the Accotink Creek bridge.

In order to achieve the stated goals of The Braddock Road Multimodal Study, the various improvement alternatives were evaluated, and ultimately a single preferred alternative was chosen. The process included developing Measurements of Effectiveness (MOE) and calculating scores for the MOEs from both the technical study team and the Task Force.

The Braddock Road Multimodal Study included studying various locations along the study corridor for a transit center, developing transit center configurations for the various locations, and evaluating the locations/configurations. The vetting process included developing Measurements of Effectiveness (MOE) and calculating scores for the MOEs from both the technical team and the Task Force. A park-&-ride configuration was later included in the study at the Kings Park Shopping Center location, as an alternative to a transit center. During the course of the study, the two viable locations chosen for further detailed study included the Northern Virginia Training Center and the Kings Park Shopping Center.

Throughout the study, the study team (FCDOT and RK&K) met with various public/community groups to present the study (improvements) data, analysis, and recommendations along with addressing any public comments/concerns. The main public outreach took place at four Community meetings held for the study. There were also numerous neighborhood/church meetings held to discuss the study and the impacts for that given neighborhood/church.

The main goal of the Braddock Road Multimodal Study included developing and evaluating various improvement options for the study corridor. Once the alternatives were developed and thoroughly vetted, both the Technical

Team (FCDOT Staff and RK&K Team) and Task Force provided recommendations for the roadway and park-&-ride/transit center.

Conclusions/Recommendations

Once the alternatives were developed and thoroughly vetted both the Technical Team (FCDOT Staff and RK&K Team) and Task Force provided recommendations for the roadway and park-&-ride/transit center. The recommendations are based the MOE evaluations, data from the analysis, and community feedback.

i. Technical Team
   a. Roadway
      Based the MOE scores and cost estimates, the Technical Team recommends the Intersection and Corridor Improvements alternative for the Braddock Road Corridor.

   b. Park-&-Ride and Transit Center
      Conclusions:
      1. If a transit center is built, the Kings Park Shopping Center location is the best option compared to the training center site.
      2. Based on staff's analysis of the MOE's and other factors, a park-&-ride lot is a reasonable alternative to a transit center at Kings Park Shopping Center.
      3. If a transit center or park-&-ride are not constructed at this time, it is suggested that the Kings Park Shopping Center location be reconsidered in the future.

      Recommendations:
      1. Construct the park-&-ride Lot at the Kings Park Shopping Center site with the roadway improvements.
      2. Reconsider a transit center at the Kings Park Shopping Center site in the future.

ii. Task Force
   a. Roadway
      Based the MOE scores and cost estimates, the Task Force recommends the Intersection and Corridor Improvements alternative for the Braddock Road Corridor.

   b. Park-&-Ride and Transit Center
      Based on an evaluation of the proposed transit center and park-&-ride lot alternatives, the Braddock Road Multimodal Study Task Force (Task Force) came to the following conclusions:
      1. The Task Force is not opposed to a transit center at the Northern Virginia Training Center site.
      2. The Task Force opposes a transit center at the Kings Park Shopping Center site. Any further consideration of a transit center at the Kings Park Shopping Center site should not occur until after the proposed roadway improvements are completed and the transit center can be evaluated based on actual data from the improved roadway network.
      3. The Task Force does not support a park-&-ride lot at the Kings Park Shopping Center site at this time. The Task Force recommends that any further consideration of a park-and-ride lot at the Kings Park Shopping Center site be deferred until after the proposed roadway improvements are completed and the park-and-ride lot can be evaluated based on actual data from the improved roadway network.

iii. Cost Estimates

a. Roadway

A conceptual level cost estimate was developed for each of the improvements alternatives that includes construction and Right-of-Way costs.

- Intersection and Corridor Improvements $35.0 Million
- Widening Alternative: HOV Inside Lanes $101.7 Million
- Widening Alternative: General Purpose Lanes $101.7 Million

The widening alternatives are much higher in cost compared to the Intersection and Corridor Improvements alternative because of the greater amount of construction required, right-of-way required, and requires an on-ramp lane extension of the two-lane ramp from Eastbound Braddock Road to I-495 Southbound. See Appendix E for the detailed conceptual level cost estimates.

b. Park-&-Ride and Transit Center

A conceptual level cost estimate was developed for each of the options that includes construction and right-of-way costs.

- Northern Virginia Training Center: Transit Center $10.73 Million
- Kings Park Shopping Center: Park-&-Ride $9.92 Million
- Kings Park Shopping Center: Transit Center $22.97 Million

The Kings Park Shopping Center: Transit Center option has a higher cost due to the proposed parking garage that would be a part of the option. See Appendix G for the detailed conceptual level cost estimates.

iv. Final Recommendations

a. Roadway

Based on both the Technical Team and Taskforce recommendations along with the MOE evaluations, data from the analysis, community feedback, and cost estimates the Intersection and Corridor Improvements alternative is the recommended improvement alternative for the Braddock Road Corridor.

b. Park-&-Ride and Transit Center

Based on both the Technical Team and Taskforce recommendations along with the MOE evaluations, data from the analysis, community feedback (including a survey on the a potential park-&-ride at Kings Park Shopping Center), and cost estimates; a park-&-ride lot or transit center will not be included with the roadway improvements or pursued further at this time.

<u>Next Steps</u>

i. Present Final Recommendations to Board of Supervisors

a. Present both the Technical Team and Task Force recommendations for the Roadway and park-&-ride/transit center. Note: The recommendations were presented on November 21, 2017 and were endorsed by the Board of Supervisors.

ii. Fall Community Meetings/Workshops

a. Meet with various neighborhoods and church communities to review the recommendations and the impacts on the community. Note: Six meetings/workshops were held from September through December 2017.

iii. Initiate project implementation of recommended alternative
  a. Issues/concerns to be considered during design (see Chapter 9 for full list and details):
    - Parkwood Baptist Church Access
    - Woodland Way Access from Burke Lake Road
    - Port Royal Road Access from I-495
    - Ravensworth Road improvements

Figure ES-1 below is the estimated timeline for the Braddock Road Multimodal improvements.

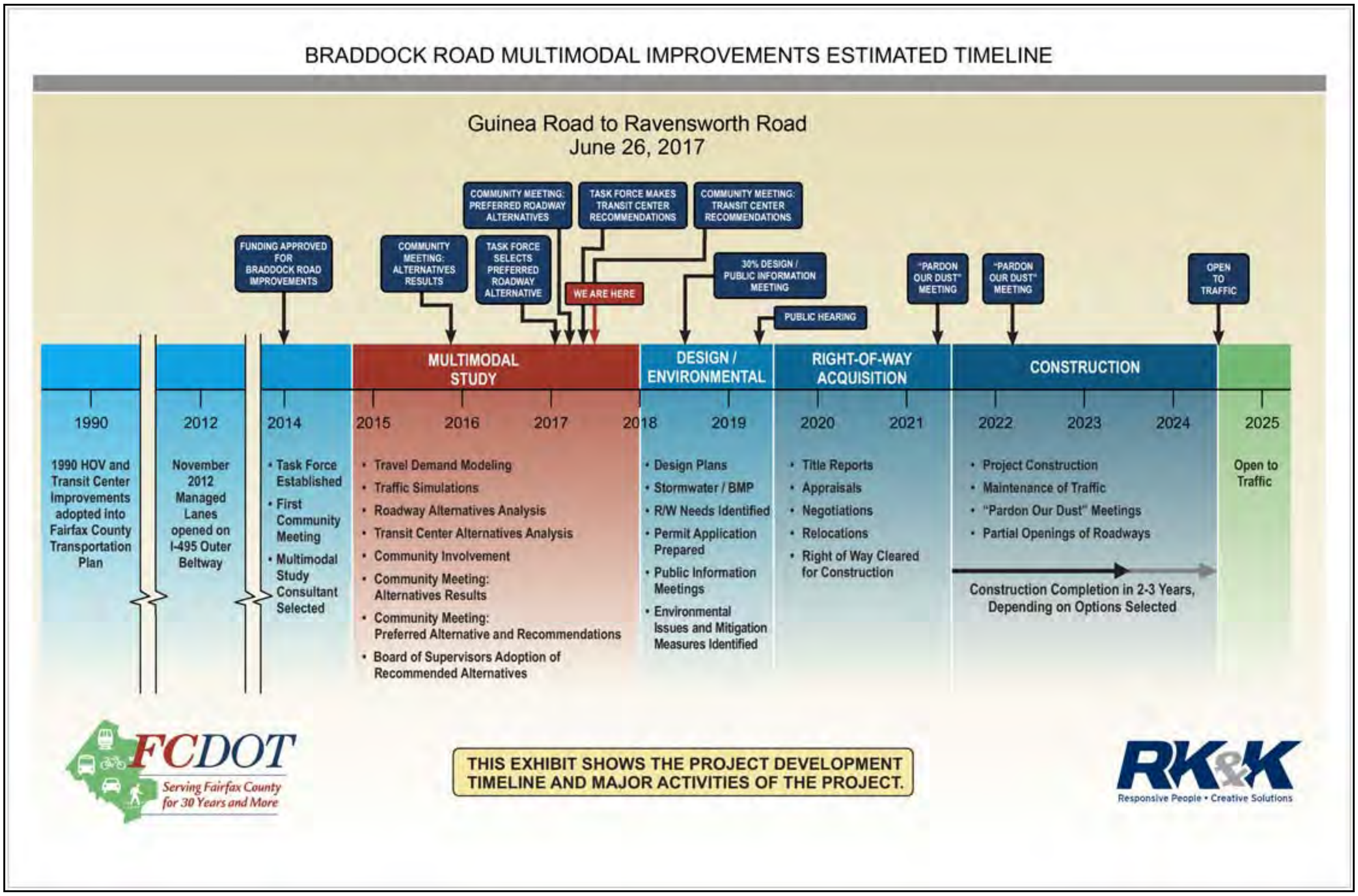


Figure ES-1: Braddock Road Estimated Timeline

Chapter 1: Introduction

The Braddock Road Multimodal Study was undertaken by the Fairfax County Department of Transportation (FCDOT) to evaluate potential improvements along the corridor from Guinea Road to I-495. Once the future traffic was evaluated and it was determined that improvements to the Ravensworth Road intersection were required thus the potential improvements were extended past I-495 to include Ravensworth Road. The potential improvements are focused to address the anticipated traffic congestion, due to increased vehicular demand, and improve bicycle and pedestrian access/safety along the corridor. The study limits are along Braddock Road from Twinbrook Road to Ravensworth Road, and are shown in **Figure 1-1**.

Figure 1-1: Study Area Map

Braddock Road (Route 620) is classified as a Minor Arterial and generally travels in an east-west direction. It supports commercial, retail, institutional, commuter, and residential traffic. Within the study corridor Braddock Road intersects with numerous side streets that range from arterials to local/neighborhood streets. In the eastern section of the study area Braddock Road intersects with Interstate 495 (Capital Beltway), including direct north-serving access to the I-495 Express Lane facility.

This study was focused on various goals to improve both the vehicular traffic flow and bicycle/pedestrian safety. The study goals included:

- Analyze and recommend a plan to provide multimodal improvements on Braddock Road from Guinea Road to Ravensworth Road.
- Consider an array of options for road improvements:
  - Intersection and Corridor Improvements

- General Purpose Lanes Widening
- HOV Lanes Widening (from the Fairfax County Comprehensive Plan)

- Evaluate the realignment of Danbury Forest Drive to create a four-legged intersection with Wakefield Chapel Road at Braddock Road (coincides with the recommendations of a previous study).
- Evaluate the commuter parking and potential transit center locations along the study corridor.
- Evaluate and determine bicycle and pedestrian facilities to be added or improved.
- Provide facilities that encourage transit use, carpooling and non-motorized travel.
- Evaluate project costs, environmental, permitting needs and right-of-way requirements
- Engage the community in the evaluation and solution.
  - Task Force Participation
  - Community Meetings
  - Small Citizens Group

To address the study goals mentioned above the following report summarizes the evaluation of the existing conditions, anticipated traffic conditions, and potential improvements. The report also describes the role of the citizen advisory group (Task Force), technical team (FCDOT and RK&K Team), and neighboring communities. Final recommendations are also provided within this report as guidance for the next steps of the improvement project.

Chapter 2: Braddock Road Task Force

A citizen advisory group (Task Force) was appointed by Fairfax County via the Braddock District Supervisor's office to represent the communities contained within the study area. The Task Force met monthly (except for summer and winter breaks) with the study team (FCDOT and RK&K Team) and reviewed the current study progress and the next steps.

The responsibilities of the Task force included:

- Representing the communities' interests and to disseminate the studies progress throughout the community
- Assisting in the development of the roadway improvement alternatives and park-&-ride/transit center options
- Developing Measurements of Effectiveness (MOEs) for roadway improvement alternatives and park-&-ride/transit center options
- Examining and scoring each of the roadway improvement alternatives and park-&-ride/transit center options
- Providing a recommended roadway improvement alternative and park-&-ride/transit center option (See Chapter 9 for Recommendations)

The Chair of the Task Force was Kevin Morse, Braddock Representative on the Transportation Advisory Commission and the Vice Chair was Tom Kennedy, Braddock Representative on the Trials and Sidewalks Committee. The following are the Task Force members and the community that they represent (* - former member):

Community	**Member**
Braddock District Council	George Klein
Bradfield	Dennis Guzik Don Newton*
Canterbury Woods	Paul Hopler Ron Minionis*
Carleigh (aka The Elms)	Trish McClure
Danbury Forest	Janet Nevius Marc Greidinger*
Dunleigh	Dave Moulton Kathrine White*
Friends of the Long Branch Stream Valley	Jim Hawkins

Community	Member
Kings Park	Jim Sobecke Henry Cullerton*
Long Branch	John Poreba Ron Sherwin*
Park Glen Heights	Mairi Kennedy
Ravensworth	Kevin Joyce
Red Fox Forest	Craig Taylor Richard Chobot*
Signal Hill Estates	Gregg Snow
Southport	Charlie Keightley
Stone Haven	Dottie Dane
Townes of Wakefield	Ed Bogdan Sheldon Studer*
Woodhirst	Dennis Chamot John Polis*

Chapter 3: Existing Conditions

This chapter includes a detailed description of the existing conditions related to roadway, traffic, commuter parking, natural environment, and utilities within the study corridor. **Figure 3-1** and **Table 3-1** present the existing typical section along Braddock Road and the number of lanes in each direction within the study corridor.

A. Roadway

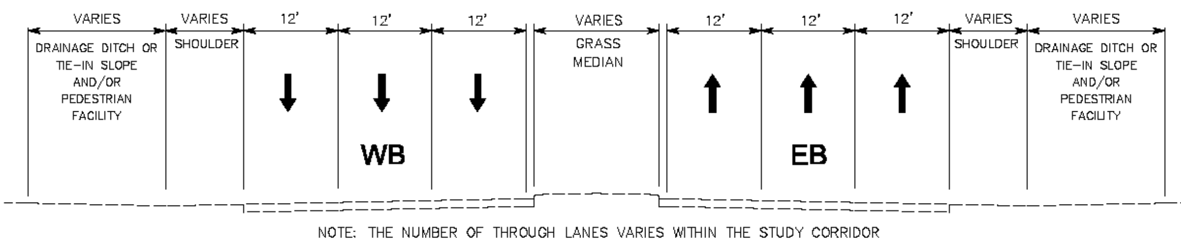


Figure 3-1: Existing Braddock Road Typical Section

From Guinea Road to Burke Lake Road	2 lanes each direction
From Burke Lake Road to Wakefield Chapel Road	3 lanes each direction
From Wakefield Chapel Road to I-495	4 lanes in Westbound direction and 3 lanes in Eastbound direction (additional lane, fourth lane, is added to the Eastbound at the Queensberry Ave intersection)
From I-495 to Ravensworth Road	2 lanes each direction

Table 3-1: Existing Braddock Road Lane Configuration

The existing Braddock Road typical section varies within the study area. The typical section from Guinea Road to Burke Lake Road includes two 12-foot through lanes in each direction with a grass median. The typical section from Burke Lake Road to Wakefield Chapel Road includes three 12-foot through lanes in each direction with a grass median. The typical section from Wakefield Chapel Road to I-495 includes four 12-foot through lanes in the westbound direction and three 12-foot through lanes in the eastbound direction with a grass median. An additional lane, a fourth lane, is introduced in the eastbound direction at the Queensberry Avenue intersection. The typical section from I-495 to Ravensworth Road includes two 12-foot through lanes in each direction with a grass median. Left and right turn lanes are provided at most intersections with a few providing dual left turn lanes. Most of Braddock Road within the study area includes shoulder design, a few intersection include curb and gutter design. The paved shoulder width varies along Braddock Road within the study area, the shoulder ranges from 1 foot to approximately 10 feet.

Asphalt paths and sidewalks are provided along most of Braddock Road with a few areas missing any pedestrian facilities. Pedestrian facilities are provided on at least one side of Braddock Road through the study area except in between the intersection of King David Boulevard/Red Fox Drive and in between the intersection of Wakefield Chapel Road/Glen Park Road. In most locations, the asphalt path is 6-7 feet wide and the distance from the edge of path and the edge of roadway varies. In various locations, the asphalt path deviates from the roadway on its own alignment. Most of the side streets that intersect Braddock Road provide sidewalks for pedestrians except for Danbury Forest Drive and Wakefield Chapel Road.

Below lists the various roadway types (classifications) that Braddock Road intersects within the study area:

Local Street (Example: Inverchapel Road)

- Primary Purpose is access
- Low volume, low speed
- Parking permitted
- Intended for neighborhoods
- No traffic signals

Collector Road (Example: Southampton Drive)

- Balances access and through movements
- moderate volume, low speed
- Parking may be permitted
- Primarily connects local streets to higher level streets
- Traffic signals only at connections to arterials

Urban Minor Arterial (Example: Rolling Road)

- Primarily serves local commuters
- Moderate volume, moderate speed
- Parking prohibited
- Primarily connections between collector streets and higher level streets
- Traffic signals at cross roads

Freeway (Example: I-495)

- Highest capacity, highest speeds
- Limited access from connecting streets at interchanges
- Parking prohibited
- High speed intercommunity access
- No traffic signals

Figure 3-2 is a map that depicts the intersections studied and **Figure 3-3** depicts the existing lane configuration of each of the intersections studied along with the existing peak hour volumes.

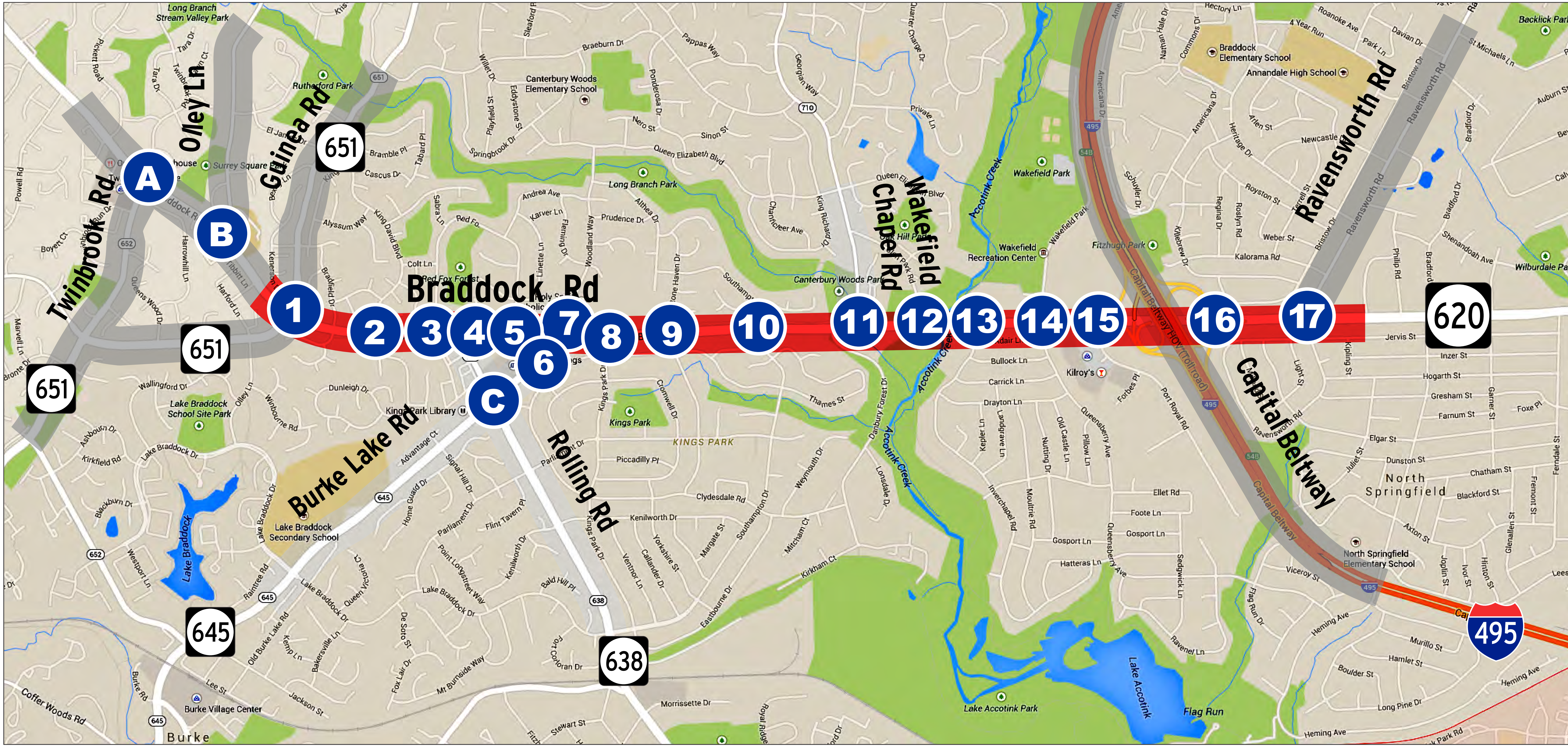


Figure 3-2: Intersections Studied

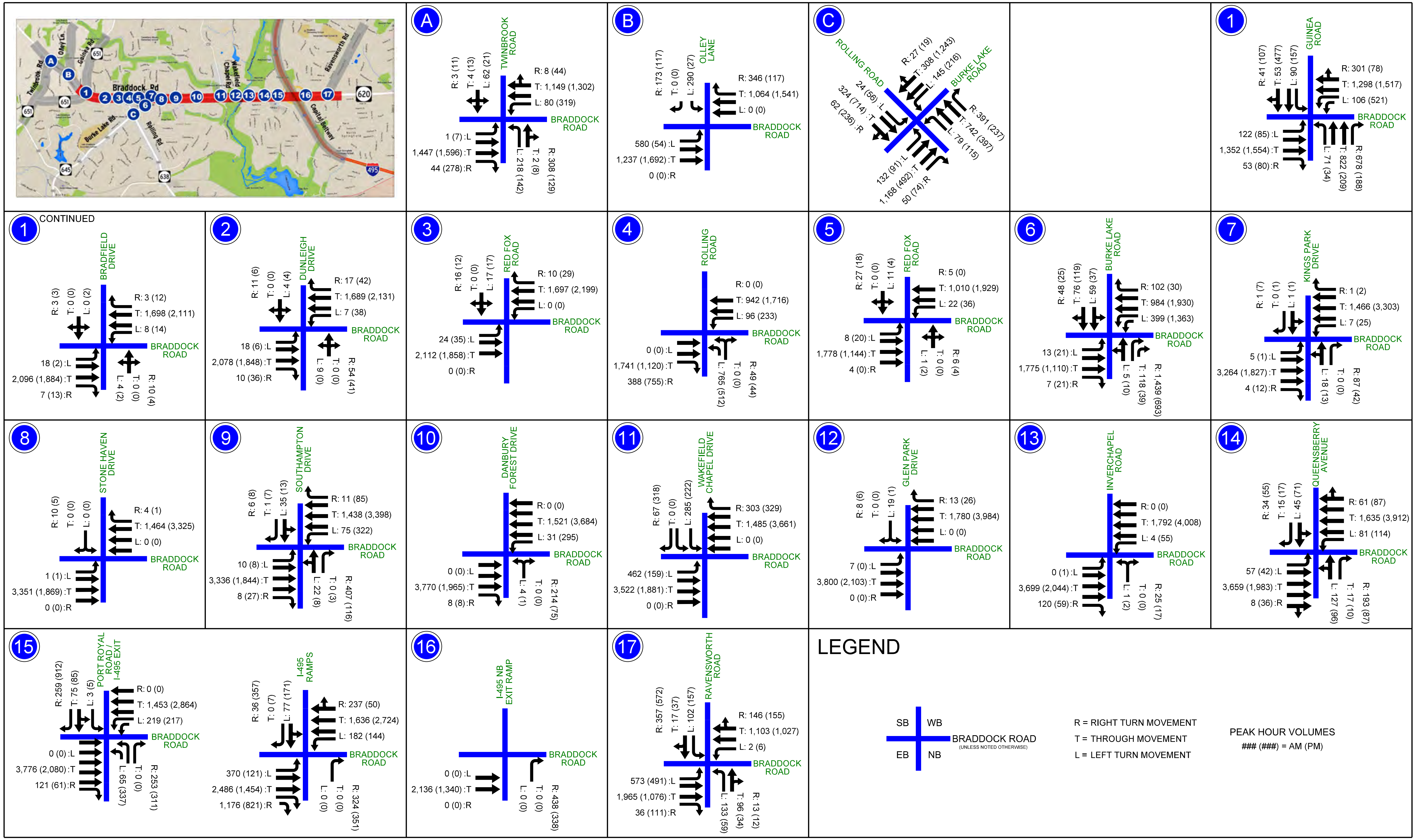


Figure 3-3: Existing Peak-Hour Volumes

B. Traffic

This section provides an overview of the methodologies and assumptions being used for VISSIM simulation model development and calibration procedures. It includes the methodology for development of the limits of the study, data collection, peak-hour demand estimates, operational parameters, and Existing Conditions VISSIM model calibration.

i. Analysis Years And Scenarios

The analysis years for this project are current year (2015) and design year (2040). The following AM and PM peak hours scenarios were analyzed in this study:

- Existing Conditions
  - Analysis of current (2015) roadway conditions.
- No-Build Alternative
  - The design year (2040) analysis with planned and/or programmed improvements as defined in the Regional's Constrained Long Range Plan (CLRP), excluding the proposed improvements as part of the Braddock Road Multimodal Study.
- Build Alternative for the design (2040) year that include the proposed improvements identified by the Braddock Road Multimodal Study, in addition to the planned/programmed improvements included in the No-Build Alternative. Four Alternatives are under consideration:
  - Alternative 1: Intersection and Corridor Improvements– spot improvements throughout the corridor. Treatments included turn bay improvements and streamlining closely spaced access points.
  - Alternative 2: HOV (High Occupancy Vehicle) Inside – integrated the above Intersection and Corridor Improvements with two additional lanes designated as HOV-2 (two or more people in a vehicle) from I-495 to Burke Lake Road, and as general purpose (GP) from Burke Lake Road to Guinea Road. The HOV lanes were located on the inside/median side (left side in direction of travel) of the roadway.
  - Alternative 3: HOV Outside – integrated the above Intersection and Corridor Improvements with two additional lanes, designated as HOV-2 from I-495 to Burke Lake Road, and as GP from Burke Lake Road to Guinea Road. The HOV lanes were located on the outside (right side in direction of travel) of the roadway
  - Alternative 4: General Purpose Widening – integrated the above Intersection and Corridor Improvements with two additional lanes from I-495 to Guinea Road.

Additional details on the Alternatives are provided in Chapter 5.

ii. Study Area Limits

The following roadways, ramps and intersections were included in the VISSIM modeling efforts. All Braddock Road ramps that served the traffic entering or exiting I-495 general purpose and I-495 Express Lanes. Braddock Road between Twinbrook Road and Ravensworth Road was analyzed. The corridor included the following signalized intersections, listed west to east:

1. Twinbrook Road
2. Olley Lane
3. Guinea Road
4. Rolling Road

5. Burke Lake Road/Woodland Way
6. Kings Park Drive/church driveway
7. Southampton Drive
8. Wakefield Chapel Road
9. Queensbury Avenue/Wakefield Park
10. Port Royal Road/ southbound I-495 off-ramp
11. I-495 Express Lanes access
12. Ravensworth Road
13. Twinbrook Road/Guinea Road
14. Burke Lake Road/Rolling Road

The I-495 mainline and the merge/diverge points of the collector-distributor (CD) road were not Included in the study area, as the observed conditions indicated that congestion on the I-495 does not affect the ramp merge/diverge areas on Braddock Road. The Study Area and limits of the VISSIM network are shown in **Figure 3-4**.

Figure 3-4: VISSIM Network Study Area

iii. Calibration Field Visits

For calibration purposes, field visits were performed in 2015 on April 7th-9th and June 9th-11th. Travel time runs, queues observations and additional 15-minute counts were performed in these field visits. Additional travel time runs were conducted in the PM peak hour from September 15th-17th for validation purposes.

The AM peak hour and PM peak hour were determined to be 7:30AM – 8:30AM and 4:45PM – 5:45PM respectively. A total of 15 travel time runs were performed between these two weeks. Three (3) of these runs were discarded either because they were (1) out of the identified peak hour, or (2) during atypical weather conditions, or (3) accidents occurred during the travel time runs. The field data and model results are presented in the following sections of this document.

iv. VISSIM Model Development

VDOT's 'Traffic Operations Analysis Tool Guidebook' and FHWA's 'Traffic Analysis Toolbox Volume III: Guidelines for Applying Traffic Microsimulation Modeling Software' were used as guidelines for the development of the VISSIM models. These guidelines were the current guidelines at the time of the VISSIM models' calibration process.

Measures of Effectiveness (MOEs)

Table 3-2 presents the MOEs used for the operational analysis of the roadway network under Existing Conditions and 2040 No-Build and Build Alternatives:

Facility Type	MOEs	Unit
Network wide	Average Travel Times	Seconds
Arterial Intersections	Average Movement, Approach and Intersection Delay	Seconds per Vehicle
	Average and Maximum queue	Feet

Table 3-2: VISSIM Measures of Effectiveness

Setup of VISSIM Simulation Parameters

Detailed VISSIM simulation parameters used in the VISSIM models are as listed in **Table 3-3**. The selections of seeding time, simulation time and number of runs are discussed later in this chapter.

Parameter	2015 Existing	2040 No Build	2040 Build
VISSIM Version	Version 7 – Build 5		
Simulation Resolution	10 time steps/second		
Seeding Time	1800 seconds for AM model and 2400 seconds for PM model		
Recording Time	3600 seconds		
# of Simulation Runs	10		
Random Seeds	Starting Seed #100, with an increment of 100		
Vehicle Types	Single Occupancy Vehicle (SOV), HOV-2, HOV-3 (three or more people in a vehicle), Heavy Goods Vehicle (HGV) and Bus		

Parameter	2015 Existing	2040 No Build	2040 Build
Vehicle Compositions	From Existing Volumes	From Travel Demand Forecasts	From Travel Demand Forecasts
Arterial Car Following Model	Wiedemann 74		
Freeway Car Following Model	Wiedemann 99		
Driver Behavior ^	Default or Adjust for Calibration	Same as 2015 Existing	
Signal Controller Type	Based on timing sheet data (RBC)	Timings optimized based on demand	
Signal Controller Frequency	10		
Signal Timings/Offsets	Existing signal timing data obtained from FCDOT (Synchro files or signal timing data)	Timings optimized based on demand	
Desired Speed	For Arterials based on posted speeds (+10/- 3 mph based on recon)	Same as 2015 Existing	
Intersection Turning Speed ^	Typically used Reduced Speed Areas for Right (11-13 mph) and Left (13-17 mph) turns or based on recon at special locations	Same as 2015 Existing	
Ramp Curve Speed ^	Based on recon	Same as 2015 Existing	
Vehicle Input	Demand volume where appropriate ^	Based on forecasts from travel demand model	
Vehicle Routing	Origin-Destination (O/D) matrix from survey. ^^	Based on the O/D forecast from travel demand model	
Lane Change Distance ^	Arterials default of 656 ft. Adjusted for calibration.	Same as 2015 Existing	

Table 3-3: VISSIM Simulation Parameters

Note: “recon” refers to information collected from field observations in April 2015.

^ - Refer to Appendix H for a calibration log with all the changes made to the model for calibration

^^ - Refer to Appendix I for the development of the Existing Conditions O/D Matrix Seeding Time, Simulation Time and Number of Runs

Seeding Time

A VISSIM model starts with zero vehicles on the network, which is not how the peak hour actually begins in the field. Hence, time was added onto the beginning of the simulation period to allow vehicles to be on the network at the start of the data collection period.

The guidance from FHWA[1] and VDOT[2] indicated that seeding time should be determined based on either the existing peak hour travel time to traverse between the farthest points of the study network in the peak direction of travel or twice the off-peak travel time between the network study limits. This study used a seeding time twice that of the peak hour travel time between the network study limits.

The average recorded travel times in the peak direction of travel were approximately 800 seconds in the AM peak hour and 1100 seconds in the PM peak hour. The VISSIM seeding times were determined to be 30 minutes (1800 seconds) for the AM model; and 40 minutes (2400 seconds) for the PM model.

Simulation Time

Based on the size of the network, field observations and traffic counts on Braddock Road within the project limits, the models were run for one hour (3600 seconds) to capture and document the traffic performance data representative of the conditions during peak hour for the entire network.

Number of Runs

Given the stochastic nature of the microsimulation, VISSIM models were ran with several different random seeds, and the results were averaged. The number of runs was determined by the following equation recommended by VDOT's Guidebook[3].

$$N = \frac{Z^2 (S_s)^2}{E^2}$$

Where:

N = the necessary sample size,

Z = the number of standard deviations away from the mean corresponding to the required confidence level (assuming a normal distribution and confidence interval of 95th percentile, which corresponds to a value of 1.96),

S_s = the sample standard deviation, and

E = the tolerable error in terms of the sample mean.

In this study, the procedure was applied to link volumes from the VISSIM calibrated models. As suggested by FHWA and VDOT's guidelines, a 10 percent error allowance at a 95 percent confidence level is required in model calibration for all links with volumes greater than 100 vehicles. Calculated from the results from initial 10 model runs, the numbers of runs required at 95 percent confidence level were determined to be:

For AM peak hour -

- Nine (9) based on volume throughput.
- Four (4) based on corridor-wide travel time.

For PM peak hour -

- Six (6) based on volume throughput.
- Three (3) based on corridor-wide travel time.

[1] Traffic Analysis Toolbox Volume III: Guidelines for Applying Traffic Microsimulation Modeling Software; FHWA

[2] Traffic Operations Analysis Tool Guidebook, August 2013; VDOT

[3] Traffic Operations Analysis Tool Guidebook Version 1.1, p.23. VDOT Traffic Engineering Division, August 2013.

To be conservative, the numbers of runs was decided to be 10 for all the models. Hence, the final calibration results from the existing conditions models as well as future year models were reported using the average of 10 runs for both AM and PM models.

v. VISSIM Model Calibration

Calibration MOEs and Criteria

In this study, three (3) measures of effectiveness (MOEs) were used to verify the adequacy of the calibration:

- Capacity Calibration MOE:
  - Throughput volumes served on all roadway segments at all study intersections.
- System Performance Calibration MOE:
  - Travel time along Braddock Road in both directions.
  - Queues along Braddock Road at key intersections.

Table 3-4 shows the detailed calibration criteria, acceptance targets, and achieved targets for this model.

Criteria and Measures	Calibration Acceptance Targets	Current Model Standard (AM Peak)	Current Model Standard (PM Peak)
Hourly Flows, Model vs. Observed			
Individual Link Flows			
Within 15%, for 700 veh/h < Flow < 2700 veh/h	> 85% of cases	100%	100%
Within 100 veh/h, for Flow < 700 veh/h	> 85% of cases	100%	100%
Within 400 veh/h, for Flow > 2700 veh/h	> 85% of cases	100%	100%
Sum of All Link Flows	Within 5% of sum of all link counts	-3.0%	-1.8%
Travel Times, Model vs. Observed			
Journey Time, Network			
Within 15% (or 1 min, if higher)	> 85% of cases	100%. See Table 6 for detailed information	
Individual Link Speeds			
Visually Acceptable Speed-Flow Relationship	To analyst's satisfaction	Travel time was satisfied by sub-segment (Table 6) and thus speed calibration has been achieved	
Queues, Model vs. Observed			
Bottlenecks			
Visually Acceptable Queuing	To analyst's satisfaction	Satisfied See Figures 6 and 7	Satisfied See Figures 8 and 9

Table 3-4: Calibration Criteria[4]

[4] Source: *Traffic Analysis Toolbox Volume III: Guidelines for Applying Traffic Microsimulation Modeling Software*, p. 63. Federal Highway Administration, June 2004.

Model Calibration Methodology

Model calibration is a process used to achieve adequate reliability or validity of the model by establishing suitable parameter values so that the model replicates local traffic conditions as closely as possible. The FHWA's Toolbox recommended a three-step strategy for calibration[5], (1) capacity calibration, (2) route choice calibration, and (3) system performance calibration.

As mentioned in the previous section, three field measurements: throughput volumes on all links, travel time, and queues were used as the key targets in the base model calibration procedure for this study. Throughput volumes were used as the primary capacity target. The system performance targets, travel times and queues are used as secondary targets.

1. Capacity calibration: VISSIM model parameters were adjusted to meet the calibration criteria of the throughput volume target. These candidate parameters include driving behavior parameters (car-following parameters and lane-changing parameters), lane use adjustment, conflict area, and lane change distance for different facilities.
2. System performance calibration: Travel time from VISSIM model results were then compared to field measurements. Traffic demand, link free-flow speed and capacity related parameters were further refined to better match the field conditions.
3. Visual review: VISSIM simulation animation was reviewed to check queuing and congestion conditions at key bottleneck locations. **Figure 3-5** through **Figure 3-9** presented in Calibration Results section of this document compared field queues documented versus VISSIM queues recorded.

AM peak hour-

- Wakefield Chapel Road: The eastbound left traffic at this location was observed to spill back into the through lanes and had often impacted the capacity of the through lanes. As a result, eastbound queues reached Southampton Road occasionally.
- Southampton Road: Based on observations, queues at this location were partially generated due to operations at Wakefield Chapel Road. Apart from that, the eastbound left green time at this location was observed to limit the throughput causing queues that reached King Park Drive and occasionally to Burke Lake Road.
- Eastbound Twinbrook Road: During one of the travel time runs, traffic from Guinea Road was observed to spillback to Twinbrook Road.
- Eastbound Rolling Road: Occasionally, queues were observed to spillback to Guinea Road from Rolling Road in eastbound direction.

PM peak hour-

- Guinea Road: The westbound approach at Guinea Road was observed to be a major bottleneck with queues reaching Rolling Road regularly and Burke Lake Road occasionally.
- Burke Lake Road: The westbound left movement at Burke Lake Road resulted in queues that reached Wakefield Chapel Road on a regular basis.
- Port Royal Road: The westbound queues from this location were observed to impact the high-occupancy toll (HOT) lanes ramp regularly and reach the loop ramp from I-495 northbound occasionally.

The model parameters were adjusted to reflect actual network performance and driver behaviors in an iterative process. The model was run with adjusted parameters, and the outputs were examined against field

[5] *Traffic Analysis Toolbox Volume III: Guidelines for Applying Traffic Microsimulation Modeling Software*, Chapter 5 Calibration of Microsimulation Models. Federal Highway Administration, June 2004.

measurements. The parameter adjustments continued incrementally within reasonable ranges until the calibration targets were reached. All the changes to the models made for calibration purposes are documented in Appendix H.

Calibration Results

Link Throughputs

The comparisons between field volumes and calibration results of VISSIM link throughputs in terms of absolute and percentage difference is listed in **Table 3-5** and **Table 3-6**.

Table 3-5: AM Model Link Throughput Calibration Results

Node	Intersection	Control	Movement	Peak Hour Demand (veh/hr)	VISSIM Thruput (veh/hr)	Approach Demand (veh/hr)	Approach VISSIM Thruput (veh/hr)	Δ	Δ %
2	Braddock Rd & Ravensworth Rd	Signalized	EBL	573	548	2574	2460	-114	-4%
			EBT	1965	1875				
			EBR	36	36				
			WBL	2	2	1251	1248	-3	0%
			WBT	1103	1102				
			WBR	146	145				
			NBL	133	136	242	243	1	1%
			NBT	96	95				
			NBR	13	13				
			SBL	102	100	476	468	-8	-2%
			SBT	17	16				
			SBR	357	352				
125	Braddock Rd & HOT Ramp	Signalized	EBL	370	359	2856	2709	-147	-5%
			EBT	2486	2351				
			WBL	182	173	2055	2045	-10	0%
			WBT	1636	1635				
			WBR	237	237				
			SBL	77	74	113	109	-4	-4%
			SBT	0	0				
			SBR	36	35				
3	Braddock Rd & Port Royal Rd	Signalized	EBT	3776	3564	3897	3681	-216	-6%
			EBR	121	117				
			WBL	219	219	1672	1668	-4	0%
			WBT	1453	1449				
			NBL	65	60	318	287	-31	-10%
			NBR	253	226				
			SBL	0	0	86	83	-3	-3%
			SBT	75	72				
			SBR	11	11				
4	Braddock Rd & Queensbury Ave	Signalized	EBL	57	52	3724	3500	-224	-6%
			EBT	3659	3441				
			EBR	8	8				
			WBL	81	80	1777	1765	-12	-1%
			WBT	1635	1626				
			WBR	61	58				
			NBL	127	126	337	340	3	1%
			NBT	17	18				
			NBR	193	195				
			SBL	45	46	94	92	-3	-3%
			SBT	15	13				
			SBR	34	32				
5	Braddock Rd & Wakefield Chapel Rd	Signalized	EBL	462	430	3984	3724	-260	-7%
			EBT	3522	3295				
			WBT	1485	1483	1788	1771	-17	-1%
			WBR	303	288				
			SBL	285	286	352	349	-4	-1%
			SBR	67	62				
6	Braddock Rd & Southampton Dr	Signalized	EBL	8	6	3351	3097	-254	-8%
			EBT	3336	3085				
			EBR	7	5				
			WBL	75	78	1525	1522	-3	0%
			WBT	1440	1434				
			WBR	10	10				
			NBL	22	22	429	428	-1	0%
			NBT	0	0				
			NBR	407	405				
			SBL	35	36	42	41	-1	-3%
			SBT	1	1				
			SBR	6	4				
7	Braddock Rd & Kings Park Dr	Signalized	EBL	5	4	3273	3090	-183	-6%
			EBT	3264	3082				
			EBR	4	4				
			WBL	7	7	1474	1462	-12	-1%
			WBT	1466	1453				
			WBR	1	1				
			NBL	18	17	105	97	-8	-7%
			NBT	0	0				
			NBR	87	80				
			SBL	1	1	2	2	0	20%
			SBT	0	0				
			SBR	1	1				

Node	Intersection	Control	Movement	Peak Hour Demand (veh/hr)	VISSIM Thruput (veh/hr)	Approach Demand (veh/hr)	Approach VISSIM Thruput (veh/hr)	Δ	Δ %
8	Braddock Rd & Burke Lake Rd	Signalized	EBL	13	13	1795	1646	-149	-8%
			EBT	1775	1625				
			EBR	7	8				
			WBL	399	390	1485	1457	-28	-2%
			WBT	984	972				
			WBR	102	95				
			NBL	5	5	1562	1544	-18	-1%
			NBT	118	119				
			NBR	1439	1420				
			SBL	59	56	183	177	-6	-3%
			SBT	76	75				
			SBR	48	47				
9	Braddock Rd & Rolling Rd	Signalized	EBT	1741	1605	2129	1977	-152	-7%
			EBR	388	371				
			WBL	96	94	1038	1022	-16	-2%
			WBT	942	929				
			NBL	765	755	814	804	-10	-1%
			NBR	49	49				
10	Braddock Rd & Guinea Rd (North)	Signalized	EBL	122	126	1527	1496	-31	-2%
			EBT	1352	1318				
			EBR	53	52				
			WBL	106	111	1705	1684	-21	-1%
			WBT	1298	1269				
			WBR	301	304				
			NBL	71	67	1572	1476	-96	-6%
			NBT	822	789				
			NBR	679	619				
			SBL	90	86	184	180	-4	-2%
			SBT	53	51				
			SBR	41	43				
11	Braddock Rd & Olley Ln (North)	Signalized	EBL	580	584	1817	1802	-15	-1%
			EBT	1237	1218				
			WBT	1064	1041	1410	1380	-30	-2%
			WBR	346	339				
			SBL	290	292	463	461	-2	0%
			SBR	173	169				
12	Braddock Rd & Twinbrook Rd	Signalized	EBL	1	1	1492	1476	-17	-1%
			EBT	1447	1435				
			EBR	44	39				
			WBL	80	80	1237	1217	-20	-2%
			WBT	1149	1130				
			WBR	8	8				
			NBL	218	222	528	536	8	2%
			NBT	2	2				
			NBR	308	313				
			SBL	62	64	69	70	1	2%
			SBT	4	4				
			SBR	3	3				
92	Rolling Rd & Burke Lake Rd	Signalized	EBL	132	133	1350	1348	-2	0%
			EBT	1168	1164				
			EBR	50	51				
			WBL	145	138	480	477	-3	-1%
			WBT	308	310				
			WBR	27	29				
			NBL	79	77	1212	1198	-14	-1%
			NBT	742	730				
			NBR	391	391				
			SBL	24	29	410	391	-19	-5%
			SBT	324	305				
			SBR	62	58				
115	Twinbrook Rd & Guinea Rd (South)	Signalized	EBL	56	59	374	380	6	2%
			EBT	261	266				
			EBR	57	56				
			WBL	133	138	191	194	3	1%
			WBT	29	25				
			WBR	29	31				
			NBL	21	21	1575	1566	-10	-1%
			NBT	443	444				
			NBR	1111	1100				
			SBL	19	20	128	121	-7	-5%
			SBT	85	78				
			SBR	24	23				

Table 3-6: PM Model Link Throughput Calibration Results

Node	Intersection	Control	Movement	Peak Hour Demand (veh/hr)	VISSIM Thruput (veh/hr)	Approach Demand (veh/hr)	Approach VISSIM Thruput (veh/hr)	Δ	Δ %
2	Braddock Rd & Ravensworth Rd	Signalized	EBL	491	488	1678	1662	-16	-1%
			EBT	1076	1064				
			EBR	111	109				
			WBL	6	5	1188	1178	-10	-1%
			WBT	1027	1020				
			WBR	155	154				
			NBL	59	60	105	107	2	2%
			NBT	34	36				
			NBR	12	11				
			SBL	157	150	766	752	-14	-2%
			SBT	37	38				
			SBR	572	564				
125	Braddock Rd & HOT Ramp	Signalized	EBL	121	122	1575	1544	-31	-2%
			EBT	1454	1423				
			WBL	144	135	2918	2890	-28	-1%
			WBT	2724	2705				
			WBR	50	50				
			SBL	171	167	535	536	1	0%
			SBT	7	7				
			SBR	357	363				
3	Braddock Rd & Port Royal Rd	Signalized	EBT	2080	2048	2141	2111	-30	-1%
			EBR	61	63				
			WBL	217	217	3081	3074	-7	0%
			WBT	2864	2858				
			NBL	337	333	648	623	-25	-4%
			NBR	311	291				
			SBL	0	0	100	103	3	3%
			SBT	85	90				
			SBR	15	13				
4	Braddock Rd & Queensbury Ave	Signalized	EBL	42	45	2061	2038	-23	-1%
			EBT	1983	1957				
			EBR	36	37				
			WBL	114	112	4113	4089	-24	-1%
			WBT	3912	3890				
			WBR	87	88				
			NBL	96	99	193	194	1	0%
			NBT	10	10				
			NBR	87	85				
			SBL	71	71	143	143	0	0%
			SBT	17	15				
			SBR	55	56				
5	Braddock Rd & Wakefield Chapel Rd	Signalized	EBL	159	156	2040	2031	-9	0%
			EBT	1881	1876				
			WBT	3661	3540	3990	3859	-131	-3%
			WBR	329	319				
			SBL	222	214	540	517	-23	-4%
			SBR	318	304				
6	Braddock Rd & Southampton Dr	Signalized	EBL	7	8	1869	1860	-9	0%
			EBT	1844	1832				
			EBR	18	20				
			WBL	322	307	3685	3509	-176	-5%
			WBT	3310	3154				
			WBR	53	48				
			NBL	8	8	129	129	0	0%
			NBT	5	6				
			NBR	116	115				
			SBL	13	14	28	27	-1	-3%
			SBT	7	7				
			SBR	8	7				
7	Braddock Rd & Kings Park Dr	Signalized	EBL	1	1	1840	1842	2	0%
			EBT	1827	1828				
			EBR	12	12				
			WBL	25	25	3330	3164	-166	-5%
			WBT	3303	3137				
			WBR	2	3				
			NBL	13	11	55	53	-2	-4%
			NBT	0	0				
			NBR	42	42				
			SBL	1	1	9	10	1	10%
			SBT	1	2				
			SBR	7	8				

Node	Intersection	Control	Movement	Peak Hour Demand (veh/hr)	VISSIM Thruput (veh/hr)	Approach Demand (veh/hr)	Approach VISSIM Thruput (veh/hr)	Δ	Δ %
8	Braddock Rd & Burke Lake Rd	Signalized	EBL	21	20	1152	1147	-5	0%
			EBT	1110	1106				
			EBR	21	20				
			WBL	1363	1271	3323	3149	-174	-5%
			WBT	1930	1854				
			WBR	30	25				
			NBL	10	9	742	745	3	0%
			NBT	39	38				
			NBR	693	699				
			SBL	37	37	181	184	3	2%
			SBT	119	123				
			SBR	25	25				
9	Braddock Rd & Rolling Rd	Signalized	EBT	1120	1115	1875	1872	-3	0%
			EBR	755	757				
			WBL	233	230	1949	1861	-88	-4%
			WBT	1716	1632				
			NBL	512	510	556	553	-3	-1%
			NBR	44	43				
10	Braddock Rd & Guinea Rd (North)	Signalized	EBL	85	80	1719	1714	-5	0%
			EBT	1554	1549				
			EBR	80	86				
			WBL	521	490	2116	2014	-102	-5%
			WBT	1517	1442				
			WBR	78	82				
			NBL	34	32	431	431	0	0%
			NBT	209	213				
			NBR	188	186				
			SBL	157	161	741	746	5	1%
			SBT	477	476				
			SBR	107	108				
11	Braddock Rd & Olley Ln (North)	Signalized	EBL	54	47	1746	1735	-11	-1%
			EBT	1692	1687				
			WBT	1541	1465	1658	1586	-72	-4%
			WBR	117	121				
			SBL	27	27	144	145	1	0%
			SBR	117	118				
12	Braddock Rd & Twinbrook Rd	Signalized	EBL	7	7	1881	1866	-15	-1%
			EBT	1596	1586				
			EBR	278	272				
			WBL	312	304	1658	1582	-76	-5%
			WBT	1302	1234				
			WBR	44	44				
			NBL	142	145	279	281	2	1%
			NBT	8	8				
			NBR	129	129				
			SBL	21	23	45	48	3	6%
			SBT	13	14				
			SBR	11	10				
92	Rolling Rd & Burke Lake Rd	Signalized	EBL	91	88	657	657	0	0%
			EBT	492	493				
			EBR	74	76				
			WBL	216	198	1478	1383	-95	-6%
			WBT	1243	1163				
			WBR	19	22				
			NBL	115	115	749	740	-9	-1%
			NBT	397	392				
			NBR	237	234				
			SBL	56	60	1006	1009	3	0%
			SBT	714	716				
			SBR	236	233				
115	Twinbrook Rd & Guinea Rd (South)	Signalized	EBL	45	45	149	147	-2	-2%
			EBT	75	75				
			EBR	29	27				
			WBL	683	666	902	878	-24	-3%
			WBT	197	186				
			WBR	22	26				
			NBL	59	57	525	526	1	0%
			NBT	212	214				
			NBR	254	255				
			SBL	36	34	603	597	-6	-1%
			SBT	481	475				
			SBR	86	88				

Travel Time

For performance calibration, the end-to-end arterial street travel times from the VISSIM models versus field speed data are listed in **Table 3-7**. **Figure 3-5** through **Figure 3-8** present the average travel time trajectories during peak hours by six (6) sub-segments.

The comparison results showed that overall travel times through the arterial street network were within eight (8) percent between VISSIM outputs and field measurements. The travel time trajectories in AM and PM VISSIM models largely matched well with the field measurements with the exception of off-peak direction (westbound) in the morning peak hour. This direction is observed to be almost free-flow conditions in the field and needed only minimal to no calibration. Two field travel time runs were used for calibration purposes and additional runs were reasoned to be of not much additional value for the scope of this project.

Direction	Section	Distance (mi)	VISSIM Mean (sec)	Field Travel Time (sec)	Δ (sec)	Δ (%)	TT Criteria
	AM Peak Hour						
EB	EB Twinbrook to Guinea	0.59	110.4	91.0	19.4	21%	
	EB Guinea to Burke Lake	0.84	245.4	213.0	32.4	15%	
	EB Burke Lake to Wakefield	0.86	227.2	256.0	-28.8	-11%	
	EB Wakefield to I-495 HOT	0.82	119.7	99.0	20.7	21%	
	EB I-495 HOT to Ravensworth	0.54	70.9	98.0	-27.1	-28%	
	EB Braddock Rd Corridor*	3.65	728.2	758.0	-29.8	-4%	TRUE
WB	WB Ravensworth to I-495 HOT	0.49	70.7	75.0	-4.3	-6%	
	WB I-495 HOT to Wakefield	0.83	104.0	142.0	-38.0	-27%	
	WB Wakefield to Burke Lake	0.86	102.5	128.0	-25.5	-20%	
	WB Burke Lake to Guinea	0.83	167.3	157.0	10.3	7%	
	WB Guinea to Twinbrook	0.59	95.9	82.0	13.9	17%	
	WB Braddock Rd Corridor*	3.60	545.8	587.0	-41.2	-7%	TRUE
	PM Peak Hour						
EB	EB Twinbrook to Guinea	0.59	164.8	144.0	20.8	14%	
	WB Guinea to Burke Lake	0.84	228.9	228.0	0.9	0%	
	EB Burke Lake to Wakefield	0.86	99.0	87.0	12.0	14%	
	EB Wakefield to I-495 HOT	0.82	110.1	98.0	12.1	12%	
	EB I-495 HOT to Ravensworth	0.54	55.2	51.0	4.2	8%	
	EB Braddock Rd Corridor*	3.65	659.5	609.0	50.5	8%	TRUE
WB	NB I-495 to WB I-495 HOT	1.11	154.1	151.0	3.1	2%	
	WB I-495 HOT to Wakefield	0.83	166.0	150.0	16.0	11%	
	WB Wakefield to Burke Lake	0.86	242.8	197.0	45.8	23%	
	WB Burke Lake to Guinea	0.83	205.8	227.0	-21.2	-9%	
	WB Guinea to Twinbrook	0.59	65.9	75.0	-9.1	-12%	
	WB Braddock Rd Corridor*	4.22	815.8	801.0	14.8	2%	TRUE

*Travel time of vehicles traveling through the entire Braddock Rd. Corridor; not the sum of segment travel times.

Table 3-7: Braddock Road Travel Time Model Calibration Results

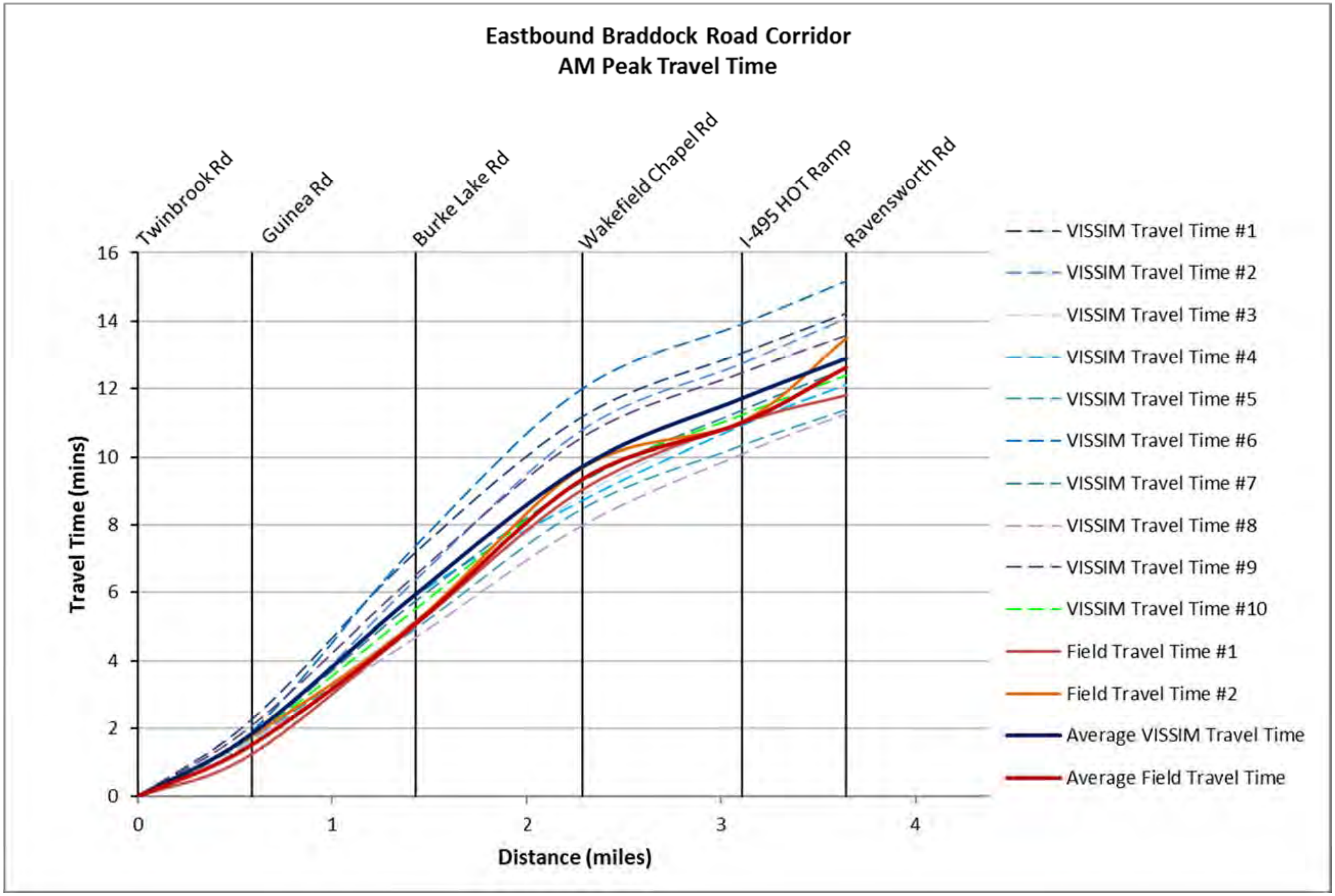


Figure 3-5: AM Eastbound Peak Hour Model Travel Time Calibration Results

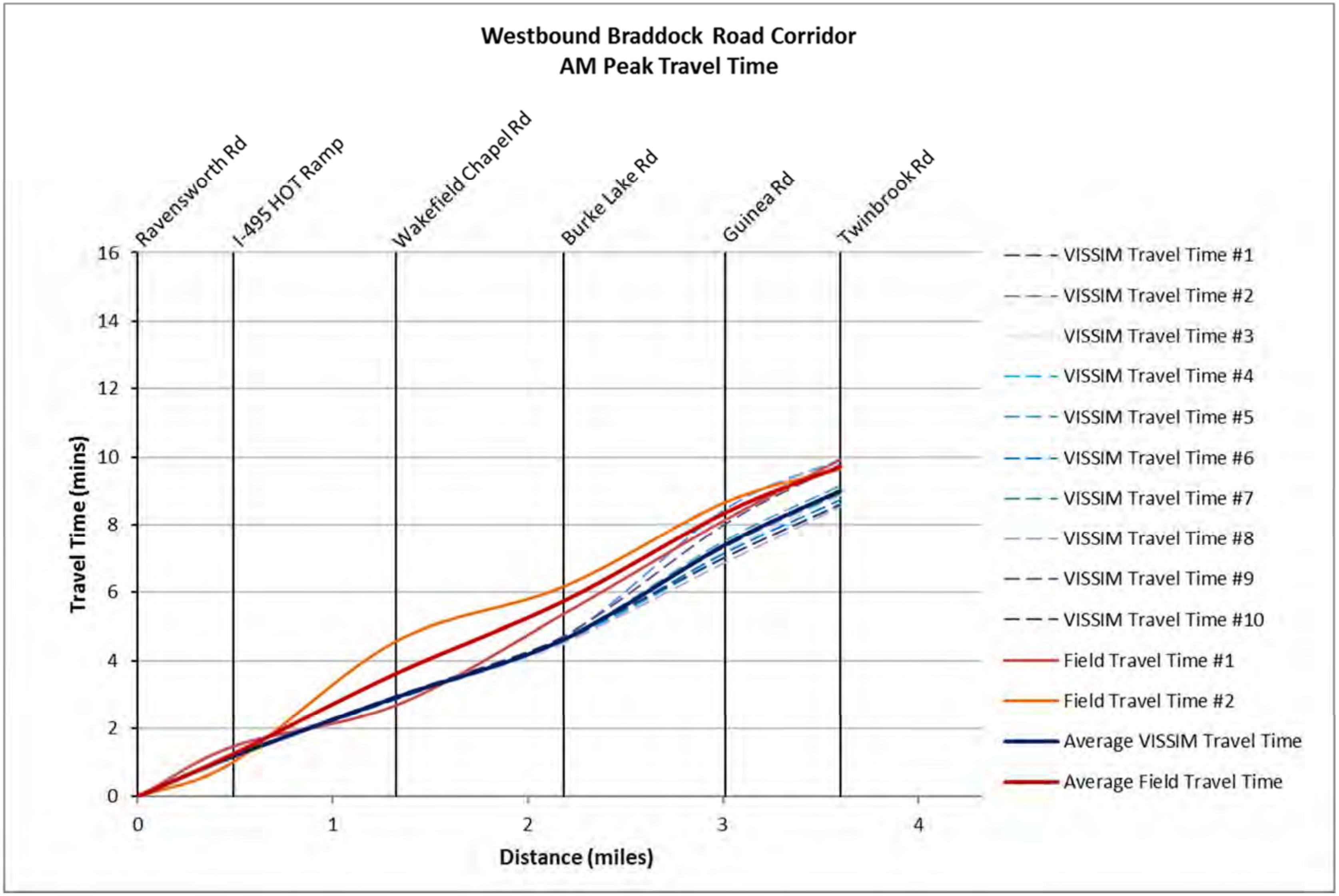


Figure 3-6: AM Westbound Peak Hour Model Travel Time Calibration Results

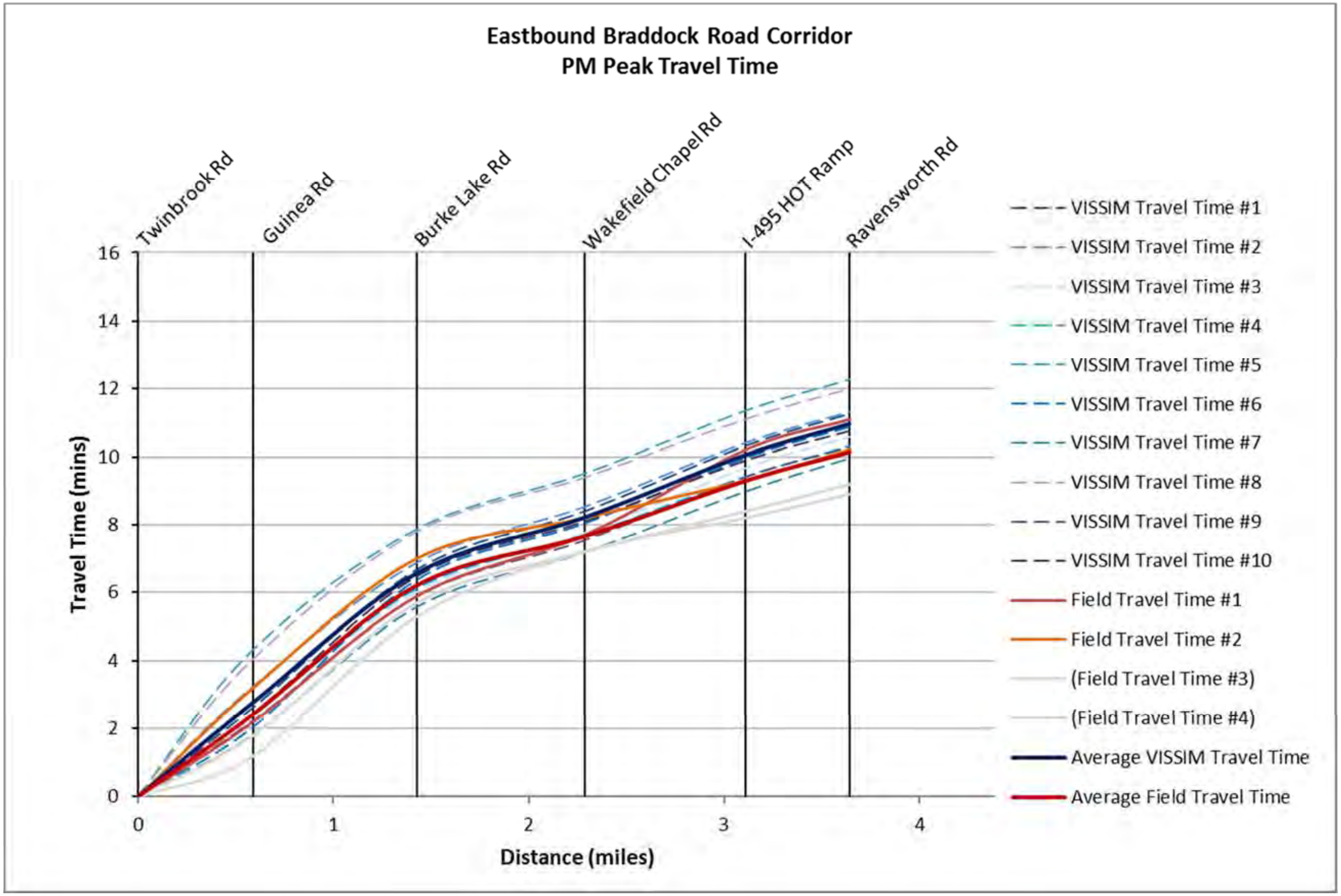


Figure 3-7: PM Eastbound Peak Hour Model Travel Time Calibration Results

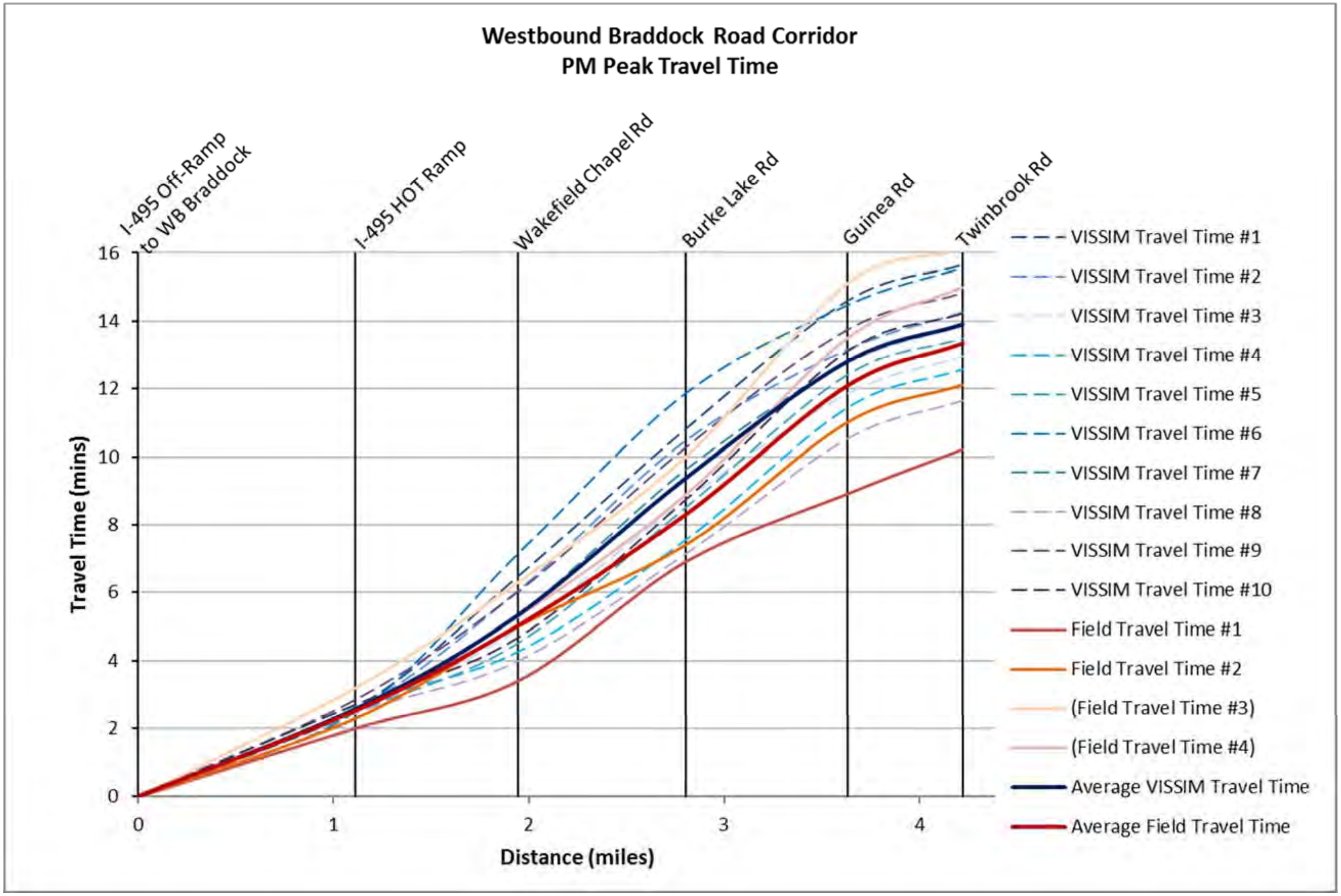


Figure 3-8: PM Westbound Peak Hour Model Travel Time Calibration Results

Queue Lengths

When queue lengths were recorded in the field, observations at each location was made in a 10-15 minute window within the defined peak hour. VISSIM simulation captured the average of (average and maximum) queues experienced by vehicles throughout the peak hour at each movement. As a result, queues observed in the field were expected to range between the average and maximum queue reported by VISSIM.

Table 3-8 compares queue length as observed in the field against the maximum queue length reported by VISSIM for six (6) critical locations – three (3) in each peak period. Human observation and perception of the queue may differ from VISSIM's method of calculating queue length, as VISSIM included a vehicle to be in queue if its speed was between 3 and 6 mph. In most locations, the VISSIM maximum queue length exceeded the length observed in the field. The queues by peak hour and direction are shown in **Figure 3-9** through **Figure 3-12**.

Travel Direction	Location	Field Queue (ft)	VISSIM Max Queue (ft)	Δ	Δ%
AM Peak Hour					
Eastbound	Burke Lake Road	4125	4275	150	4%
	Southampton Road	2930	3140	210	7%
	Port Royal Road	3100	2750	-350	-11%
PM Peak Hour					
Westbound	Burke Lake Road	5650	6325	675	12%
	Guinea Road	2275	2690	415	18%
Eastbound	Guinea Road	2740	2600	-140	-5%

Table 3-8: Critical Peak Hour Queues

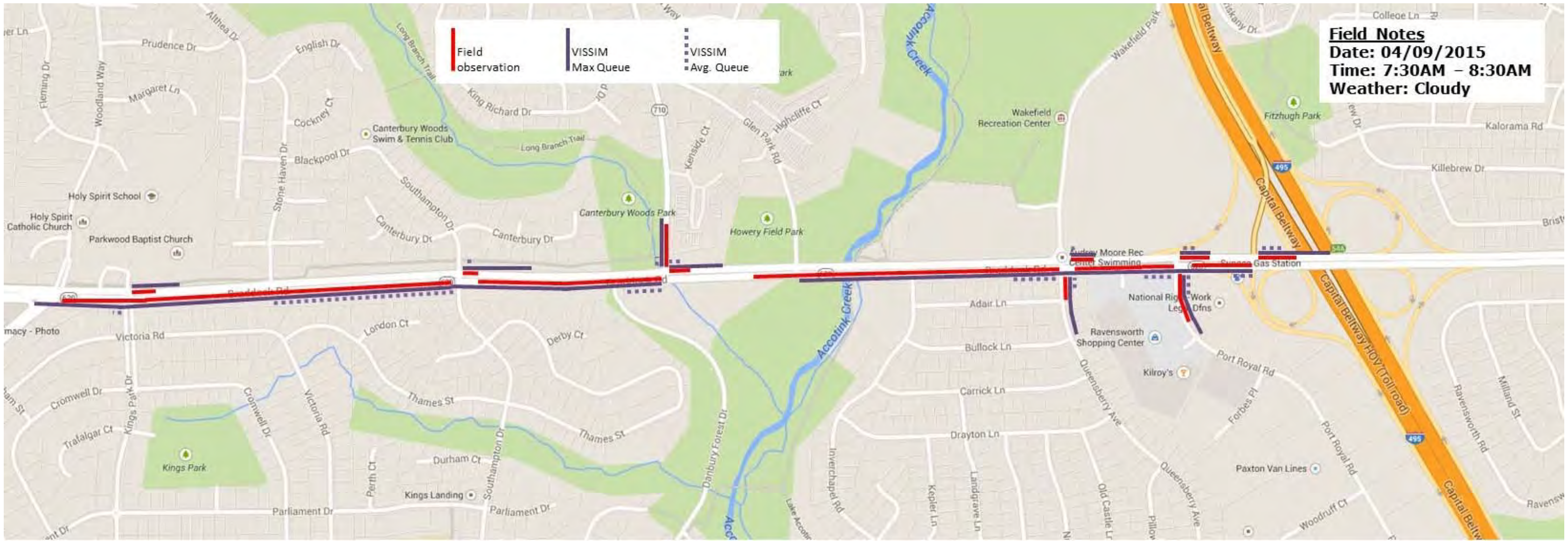


Figure 3-9: Queue Length Comparison AM Peak Hour (I-495 to Burke Lake Road) at Select Locations

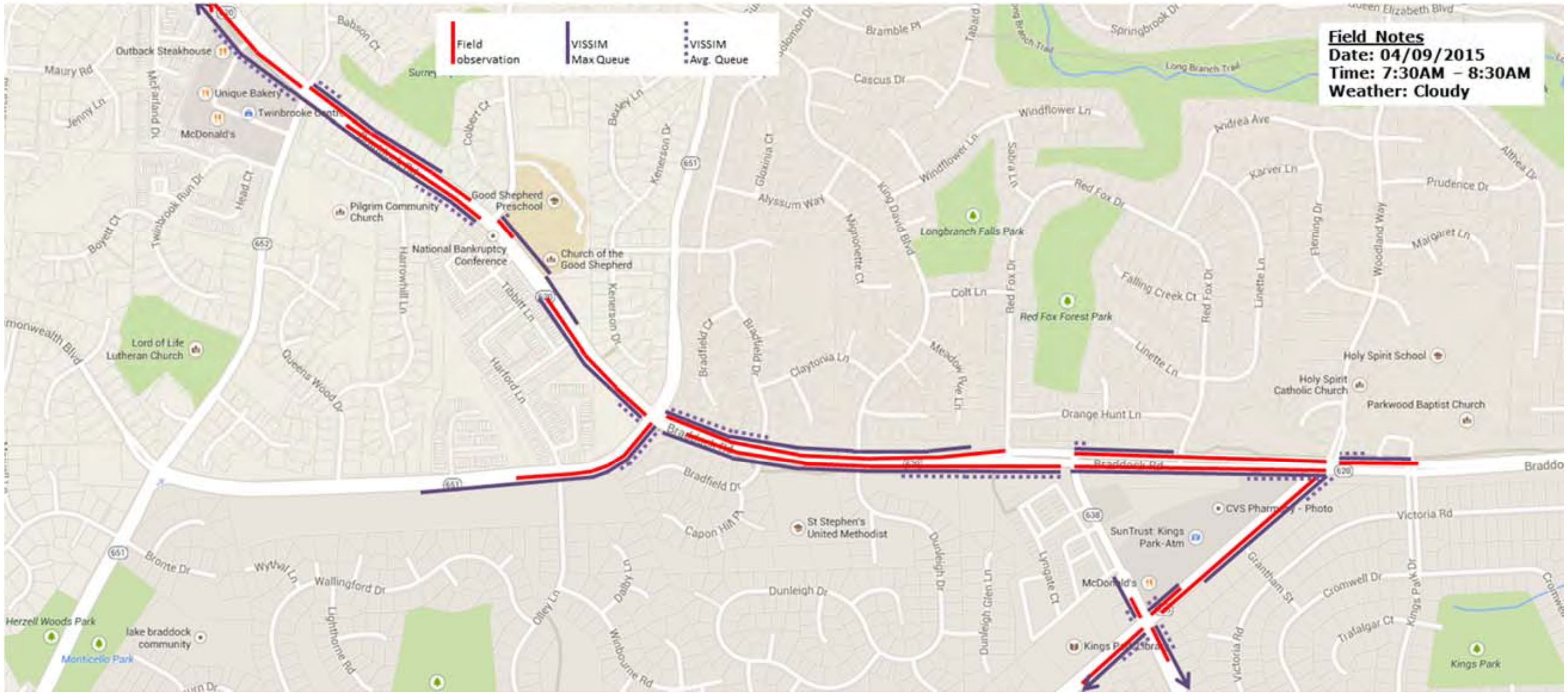


Figure 3-10: Queue Length Comparison AM Peak Hour (Guinea Road to Burke Lake Road) at Select Locations

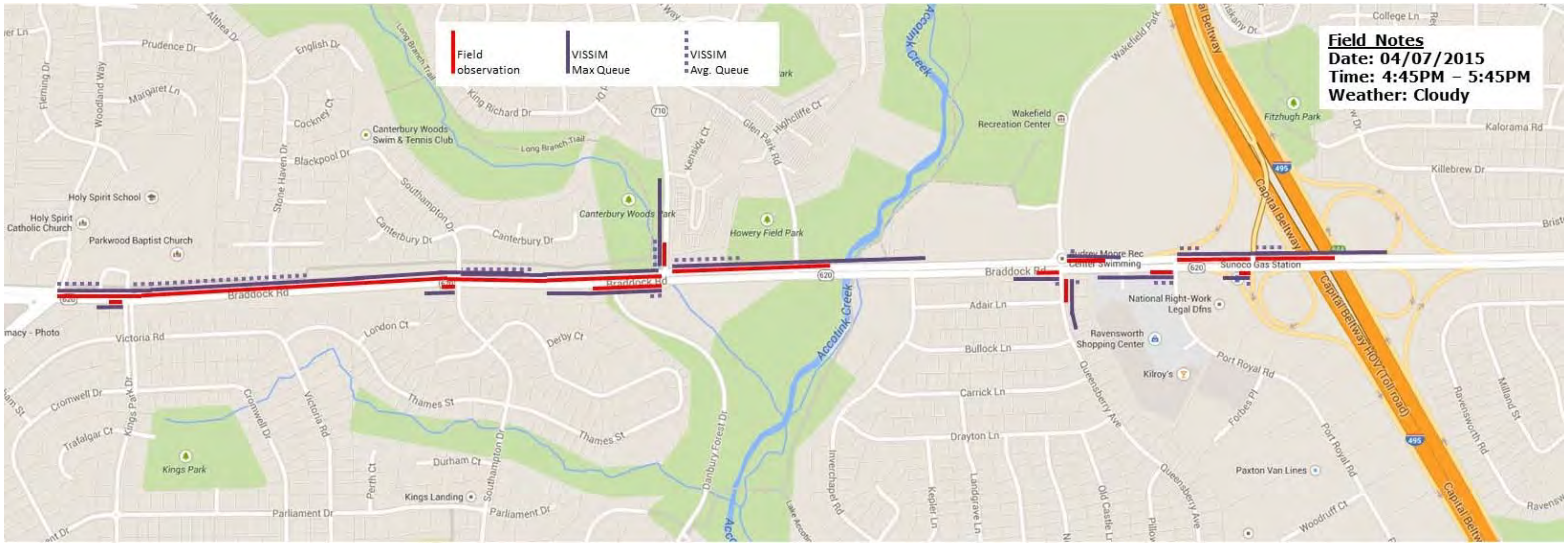


Figure 3-11: Queue Length Comparison PM Peak Hour (I-495 to Burke Lake Road) at Select Locations

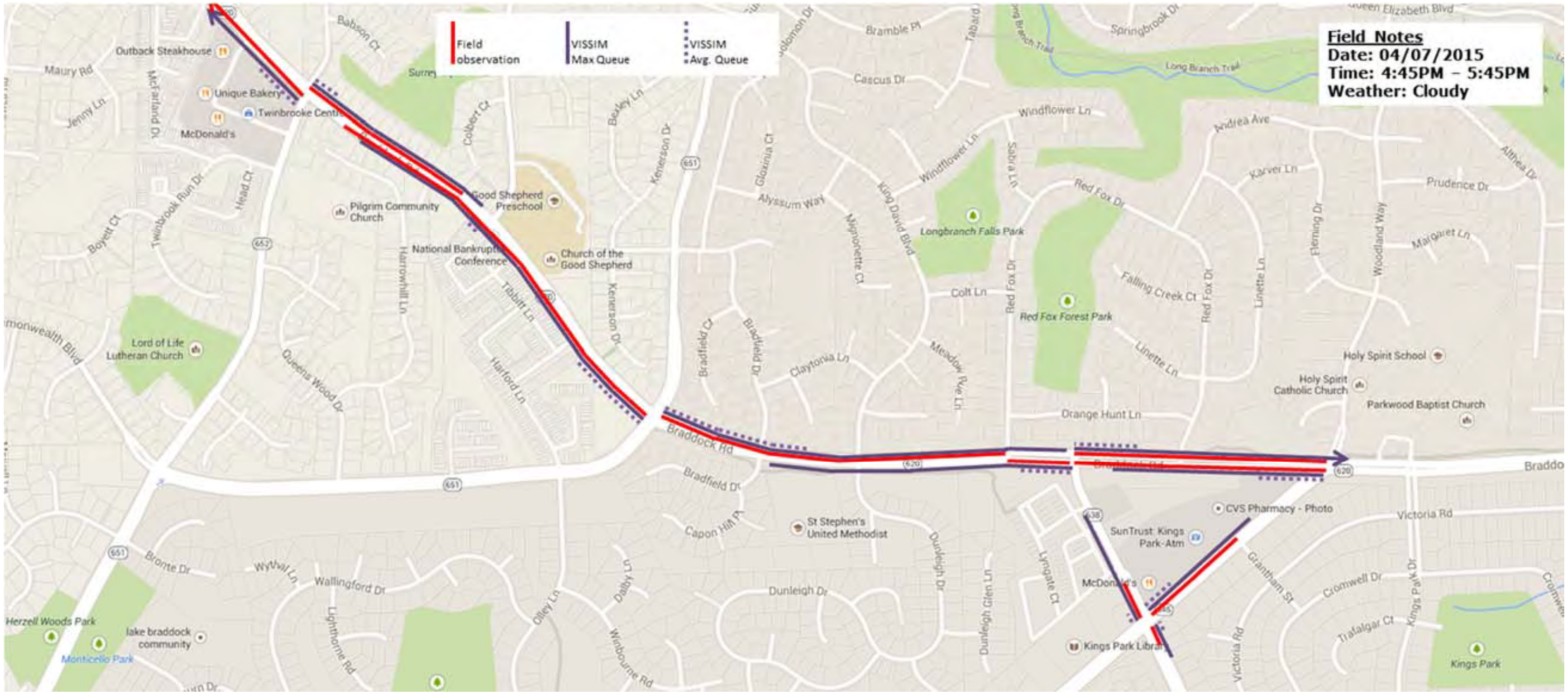


Figure 3-12: Queue Length Comparison PM Peak Hour (Guinea Road to Burke Lake Road) at Select Locations

vi. Analysis Summary – Existing Conditions

This chapter provides a summary of the 2015 Existing Conditions VISSIM analyses as well as other observations for study area. The MOEs used to summarize the Existing Conditions are:

- Intersection Level-of-Service (LOS)
- Travel time for the corridor
- Critical queues

The intersection LOS was calculated based on the overall intersection delay. The overall intersection delay was computed based on the weighted average of all the movements at the intersection. Once the intersection delay was computed, it was categorized into LOS rating which describes the overall operation of the intersection. The LOS rating is based on the Highway Capacity Manual methodology presented in **Table 3-9**.

LOS	Signalized Delay (sec/veh)	Description
A	0~10	Free-flow operations.
B	10~20	Free flow conditions with slightly lesser freedom to maneuver.
C	20~35	Might impact travel speeds with maneuverability affected by other vehicles.
D	35~55	Ability to maneuver is severely restricted due to traffic congestion.
E	55~80	Operations at or near capacity, often causing queues.
F	> 80	Forced or breakdown flow with demand exceeding the capacity.

Table 3-9: Intersection Delay Threshold for Level of Service

Source: Highway Capacity Manual.

The analyses indicated that a number of intersections operated at an undesirable LOS, as shown in **Table 3-10**. A detailed discussion on various MOEs of the study corridor are presented later in this chapter.

Time	Equivalent LOS					
	A	**B**	**C**	**D**	**E**	**F**
AM Peak Hour	0	0	5	3	5	0
PM Peak Hour	0	2	3	5	2	1

Table 3-10: Intersection LOS Summary

The findings by peak hour are summarized below:

<u>AM Peak Hour</u>

Five intersections (out of the 13 in the study corridor) operated at LOS E and are located at Ravensworth Road, Southampton Drive, Rolling Road, Guinea Road, and Twinbrook Road. Multiple traffic movements at these intersections operated at LOS F, especially in the peak directions of travel. The detailed outputs for delays and LOS by intersection are presented in Appendix L.

Observations of travel time and queues are as follows.

Eastbound Direction

- The travel time for the eastbound direction was nearly 13 minutes to traverse the 3.6 miles. Several bottlenecks existed along the corridor:
  - The eastbound left turn at Wakefield Chapel Road spilled back into the through lane impacting the operations at Southampton Drive. This impact caused queues to extend to Kings Park Drive.
  - The eastbound queue at Rolling Road spilled back to Guinea Road.

Westbound Direction

- No operational deficiencies were noted in the westbound direction, the travel time was approximately 9 minutes.

<u>PM Peak Hour</u>

Three intersections operated at undesirable LOS. Two intersections operated at LOS E and are located at Wakefield Chapel Road and Rolling Road. The third intersection operated at LOS F which is located at Guinea Road.

Observations of travel time and queues are as follows.

Eastbound Direction

- One operational deficiency was noted in the eastbound direction. The eastbound left turn lane at Wakefield Chapel Road spilled back into the through lane. However, this had minimal impact on eastbound traffic. The travel time was approximately 10 minutes.

Westbound Direction

- Several bottlenecks that were identified in the Existing Conditions. The travel time was nearly 14 minutes.
  - The westbound left turn at Twinbrook Road spilled back into the through lane and impacted the through movement.
  - The intersection at Guinea Road operated at LOS F, with multiple failing approaches. The westbound queue from Guinea Road extended back to Burke Lake Road.
  - The vehicular demand (1,360 vph) on westbound dual-left movement at Burke Lake Road was not met during the PM peak period resulting in queues that reached Wakefield Chapel Road. The spill back from the left turn impacted the through movement as well as several upstream intersections.
  - The westbound queues at Port Royal Road spilled back to the HOT lanes ramp and the loop ramp from northbound I-495.

Other observations common to both AM and PM peak hour include:

- Pedestrians jaywalked across Braddock Road to access bus stops between Guinea Road and Burke Lake Road. This might be a result of lack of signalized pedestrian crossings in this segment of Braddock Road.
- Pedestrians had to cross Braddock Road multiple times, or walk on the shoulder as there were no continuous sidewalks on either side of Braddock Road.
- At locations with short pull-off areas for bus stops, buses were observed to have difficulty merging into traffic.

Figure 3-3 (see page 3-4 of this chapter) depicts the existing lane configuration of each of the intersections studied along with the existing peak hour volumes.

C. Commuter Parking

Commuter parking is available along the Braddock Road corridor within the study area. The available parking includes both official and unofficial commuter parking lots and on-street parking along side streets intersecting Braddock Road (There is no on-street parking along Braddock Road within the study area).

The official commuter parking lots include Parkwood Baptist Church, Canterbury Woods (park), and Wakefield Park. Each of these lots are verified by Fairfax County (Fairfax County Connector Website: Park and Ride) as providing commuter parking spaces. **Table 3-11** presents amount of official parking spaces at each of the commuter parking lots.

Parkwood Baptist Church	30 Official Spaces
Canterbury Woods	29 Official Spaces
Wakefield Park	50 Official Spaces

Table 3-11: Commuter Parking Spaces

The Parkwood Baptist Church lot is located north of the Braddock Road and King Park Drive intersection, the parking is free and the lot is maintained by the Church. The Canterbury Woods lot is located north of the Braddock Road and Wakefield Chapel Road intersection, the parking is free and the lot is maintained by Fairfax County. The Wakefield Park lot is located north of the Braddock Road and Queensbury Avenue intersection, the parking is free and the lot is maintained by Fairfax County.

As part of a field visit, commuters were observed utilizing on-street parking along the side streets that intersect with Braddock Road. The side streets where parking was observed include: Stone Haven Drive, Southampton Drive, Danbury Forest Drive, Wakefield Chapel Road, Glen Park Road, Inverchapel Road, and Queensbury Avenue. Commuters were also utilizing other side streets within the study area but no evidence was observed during the field visit in January 2015.

Based on the January 2015 field visit commuters appear to also utilize The Kings Park Shopping Center and the Howery Field Park as unofficial commuter lots. The Kings Park Shopping center has signage posted urging commuters not to use the lot, while Howery Field Park has no signage posted regarding commuter parking (Howey Park is not included on the Fairfax County Connector website as a park and ride lot). See Appendix A for the summary sheet of identify existing commuter parking.

D. Environment

The Braddock Road corridor possesses a few key environmental features that will be impacted by the proposed improvements. Braddock Road is a suburban roadway that includes trees lining the roadway along most of the corridor, with the offset of the trees from the roadway varying throughout the study corridor, with some areas having offsets greater than 30 feet. The proposed improvements will also impact the Resource Protection Area (RPA) located in the eastern section of the study area. The Accotink Creek flows through the RPA and intersects Braddock Road, Braddock Road crosses the Accotink Creek on a concrete bridge structure.

E. Utilities

The existing utilities along the corridor are both buried and aerial running. From field observations and aerial imagery utility poles run along the roadway and would need to be relocated or buried if improvements are constructed. The utility poles run along the Braddock Road Eastbound lanes from Guinea Road to Burke Lake Road where they transition to Westbound lanes until the I-495 interchange. At the I-495 interchange the aerial utility lines turn away from the Improvement area and transition to underground. Buried utility lines are also located within the study area and include: gas, cable/fiber, water, and sewer.

F. Stormwater Management

There are four existing stormwater management (SWM) facilities which will be impacted by this project. Two existing SWM facilities capture a limited amount of runoff from the site. Both are dry ponds, currently maintained by Fairfax County. These facilities do not provide quantifiable water quality benefits under the current criteria and are not large enough to provide appreciable quantity control. The proposed improvements potentially impact two more SWM facilities, which provide water quantity and/or quality for offsite developments; currently, no site runoff is treated in these two facilities.

G. Land Use

Along the Braddock Road corridor are various destinations for both vehicular and bicycle/pedestrian traffic. Most of the corridor is consists of single family housing neighborhoods along with a few townhouse neighborhoods. There are two shopping center developments with the study area, the Kings Park Shopping Center is located at the intersection of Braddock Road and Burke Lake Road; the Ravensworth Shopping Center is located at the intersection of the Braddock Road and Port Royal Road. Also along the corridor are various churches and schools a few of which have entrances along Braddock Road. George Mason University is located 2.5 miles west of the western limit of the study limits. A few County parks are also located within the corridor, including Wakefield Park located at the intersection of Braddock Road and Queensberry Avenue.

Chapter 4: Traffic Forecasting

The corridor for the Braddock Road Multimodal Study covers the segments along Braddock Road from Guinea Road to I-495, extending to Twinbrook Drive to the west, Ravensworth Road to the east, and the Rolling Road/Burke Lake Road intersection to the south. For travel demand modeling and forecasting, the study area extends beyond the study corridor to include adjacent areas (see **Figure 4-1**). For traffic analysis and simulation, it includes the first signalized intersection (or ramp merge and diverge area at I-495) when traveling away from Braddock Road along the cross streets listed above, not counting the signalized intersections at Braddock Road.

Cambridge Systematics provided technical services related to the following tasks in the Braddock Road Multimodal Study:

- Task 4. Travel Demand Modeling
- Task 8. Final Recommended Alternative and Final Report
- Task 9. Task Force Participation/Meeting Presentations/Public Involvement

This chapter summarizes work activities and major findings under these tasks and addresses travel demand modeling, forecasting and analysis, including:

- Travel demand modeling and forecasting methodology and procedure
- Post-processing procedure
- Forecasting under different scenarios

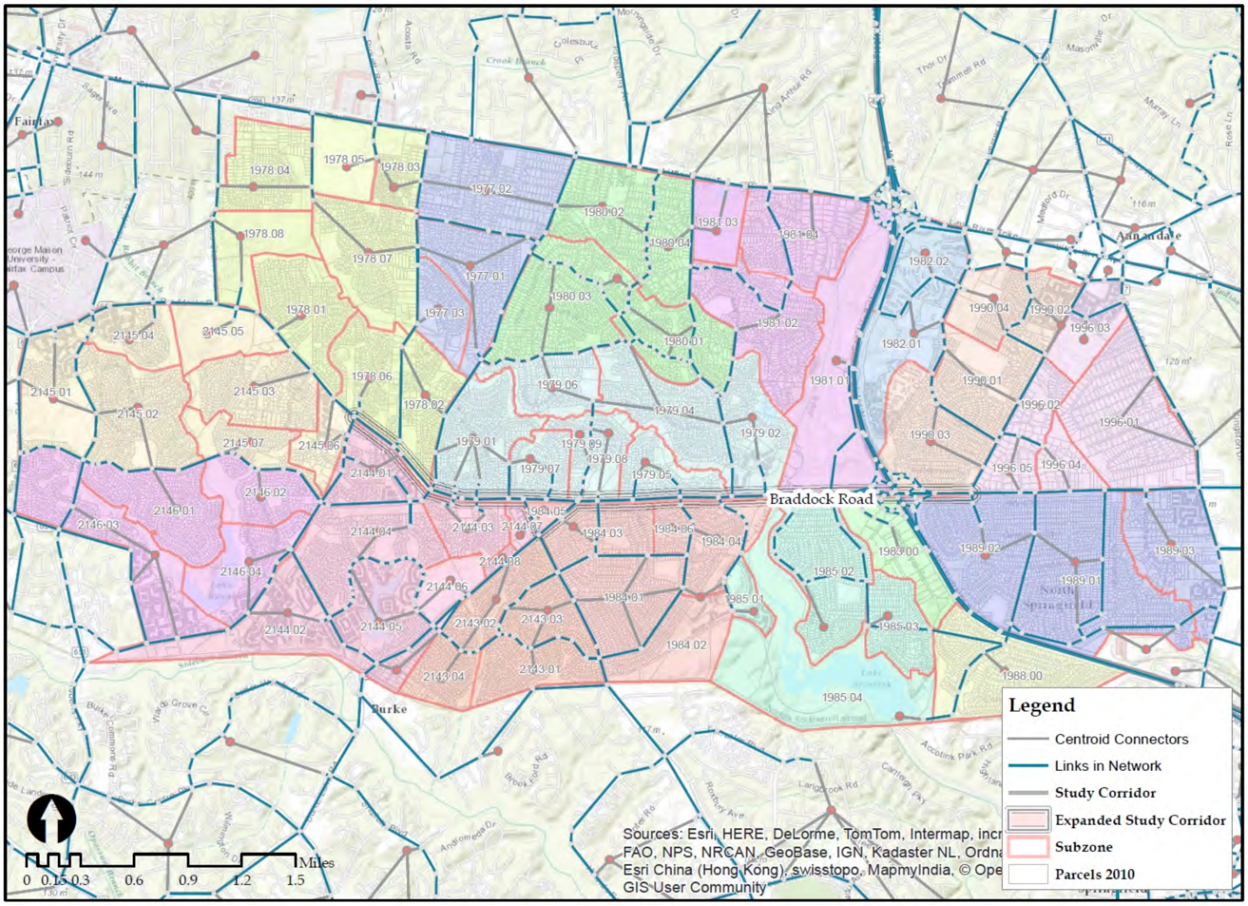


Figure 4-1: Study Area

A. Travel Demand Modeling and Forecasting Methodology and Procedure

Travel demand forecasting was conducted using a combination of metropolitan Washington regional travel demand model and Fairfax County subarea model. The regional travel demand model used in this project is the TPB/MWCOG Version 2.3.57, the latest version of TPB/MWCOG model at the time of project initiation. Version 2.3.57 was used in the Air Quality Conformity Determination of the 2014 Financially Constrained Long Range Transportation Plan (CLRP) and FY 2015-2020 Transportation Improvement Program (TIP), reflecting the latest planning assumptions at the beginning of this corridor study. Two major inputs to the model include: 1) the transportation network that represents the 2014 CLRP and FY 2015-2020 TIP; and 2) MWCOG Round 8.3 Cooperative Forecasts for land use.

The Version 2.3.57 model is a sophisticated, conventional trip-based travel demand model with six major steps:

- Demographic models with market stratifications by four household income groups, four household size groups, and four vehicle availability groups;
- Trip generation models for five personal trip purposes, a commercial vehicle trip purpose, and two truck trip types;

- Trip distribution model with doubly-constrained gravity model formulation with a composite impedance of transit and highway travel times;

- Mode choice model with nested logit structure for five trip purposes and two time periods;

- Time of day model with four time periods – AM peak, midday, PM peak, and night time/early morning; and

- Traffic assignment with six user classes and equilibrium assignment methodology.

Version 2.3.57 was calibrated and validated at the regional level. For this study, the model set was refined in the following ways:

- Highway network review and refinements based on the existing roadway conditions;

- Comparisons of estimated traffic volumes vs. observed traffic counts in the study area

The Braddock Road Multimodal Study will evaluate alternatives related to high-occupancy vehicle (HOV) and high-occupancy toll (HOT) travel, using the latest official release of the TPB/MWCOG model Version 2.3.57, in conjunction with the latest Fairfax County Model. TPB Model Version 2.3.57 models HOV as part of the mode choice and traffic assignment and simulates HOT as part of the traffic assignment process.

B. HOV Modeling in Mode Choice Model

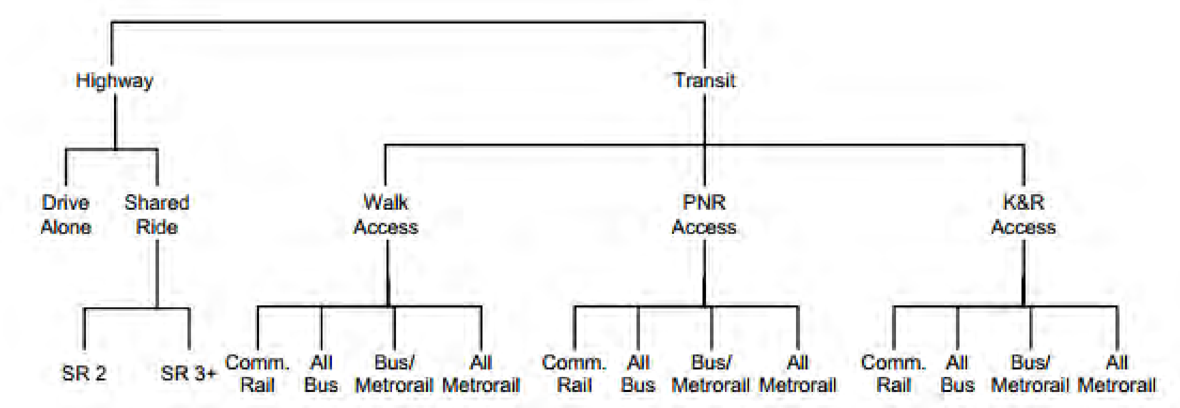
The mode choice model of the TPB model Version 2.3.57 is a nested logit model with a nesting structure shown in Figure 1. The nesting structure starts with two motorized modes (auto and transit), which are further branched out based on the types of auto occupancies (drive alone, shared ride 2 person, and shared ride 3+ person) and four transit submodes (commuter rail, all bus, all Metrorail, and combined bus/Metrorail). The transit submodes are further stratified by three modes of access to transit—park-&-ride (PNR), kiss-&-ride (KNR), and walk.

HOV trips consist of shared ride 2 (HOV 2) and shared ride 3+ (HOV 3+). The choice of HOV travel is determined based on the comparative advantages of travel time, travel costs, and convenience/necessity (e.g., joint household travel). The variables explicitly included in the model include:

- In-vehicle time
- Auto access time
- Walk access time
- Other out-of-vehicle time
- Costs (auto operating cost, transit fare, parking, toll).

The effects of these variables vary by trip purposes, which include home-based work, home-based shopping, home-based other, non-home-based work, and non-home-based other. The effects of costs also vary by household income levels, with four income groups defined in the model.

Besides these time and cost variables, other factors also affect a traveler’s choice of modes but cannot be measured in the mode choice model. The aggregate effects of those variables that cannot be quantified are typically reflected by constants in the mode choice model. These constants were calibrated using the 2000 Census, 2007/08 Household Travel Survey and 2008 Metrorail Survey data. These unmeasured effects were calibrated for the 15 mode options in 20 geographic markets in the region.



Sources: TPB/MWCOG. 2014. User's Guide for the MWCOG/NCRTPB Travel Forecasting Model, Version 2.3, Build 57: Volume 1 of 2: Main Report and Appendix A (Flowcharts).

Figure 4-2: Nesting Structure of the Nested-Logit Mode Choice Model

C. HOV and HOT Modeling in Traffic Assignment

The Version 2.3 travel model uses a static, multi-class, user-equilibrium traffic assignment process for four time periods of a day:

- AM peak period (3 hours: 6:00 AM to 9:00 AM)
- Midday period (6 hours: 9:00 AM to 3:00 PM)
- PM peak period (4 hours: 3:00 PM to 7:00 PM)
- Night/early morning period (11 hours: 7:00 PM to 6:00 AM)

The trips of all purposes in each time period are assigned to the network, using six user classes:

- Single-occupant vehicles (SOV)
- Two-occupant HOVs (HOV 2)
- Three or more-occupant HOVs (HOV 3+)
- Commercial vehicles
- Medium/heavy truck
- Airport auto driver

The distinction of travelers in SOV, HOV 2 and HOV 3+ vehicles allows the Version 2.3 model to consider different usage rules of the highway links, such as links that exclude SOVs but allow HOV 2 and HOV 3+, as reflected by the existing operation of I-66 during the peak periods in the peak direction. Similarly, the usage rules can allow for the usage of links by only HOV 3+ vehicles and prohibit the usage of links by SOV, HOV 2, and trucks during the peak periods.

The Version 2.3 travel model has a special model run procedure to address the stated policy of Virginia Department of Transportation (VDOT) that HOT facilities will not degrade the operations of HOV users. HOV 3+ vehicles are assumed to operate at a speed that is not affected by addition of non-HOV 3+ vehicles on a HOT lane.

Traffic assignment incorporates the effects of toll by converting tolls into time equivalents through values of times (VOT). VOT values vary by six user classes and four time periods.

D. Fairfax County Model

The Fairfax County model is based upon, and is an extension of, the regional travel demand model developed by the TPB/MWCOG for regional transportation planning and air quality conformity analysis. The Fairfax County model is a focused travel demand model with the following enhancements and features:

- A refined traffic analysis zone (TAZ) detail in the Fairfax County portion of the region;
- An enhanced highway network that's compatible with the refined TAZ structure;
- A linkage with the TPB/MWCOG model to disaggregate the Fairfax County portion of the regional trip table to the refined TAZ structure;
- An intersection modeling procedure that incorporates intersection delays in traffic assignment; and
- A drive-access-to-transit procedure that assigns drive-to-Metro trips to the highway network.

This additional detail produces more accurate estimates of traffic volumes at a smaller scale of resolution than has been available previously. Specifically, the model should provide more useful information at the level of arterials and collector functional classifications. This approach reduced development time and maximized the Fairfax County model's compatibility with the TPB/MWCOG model.

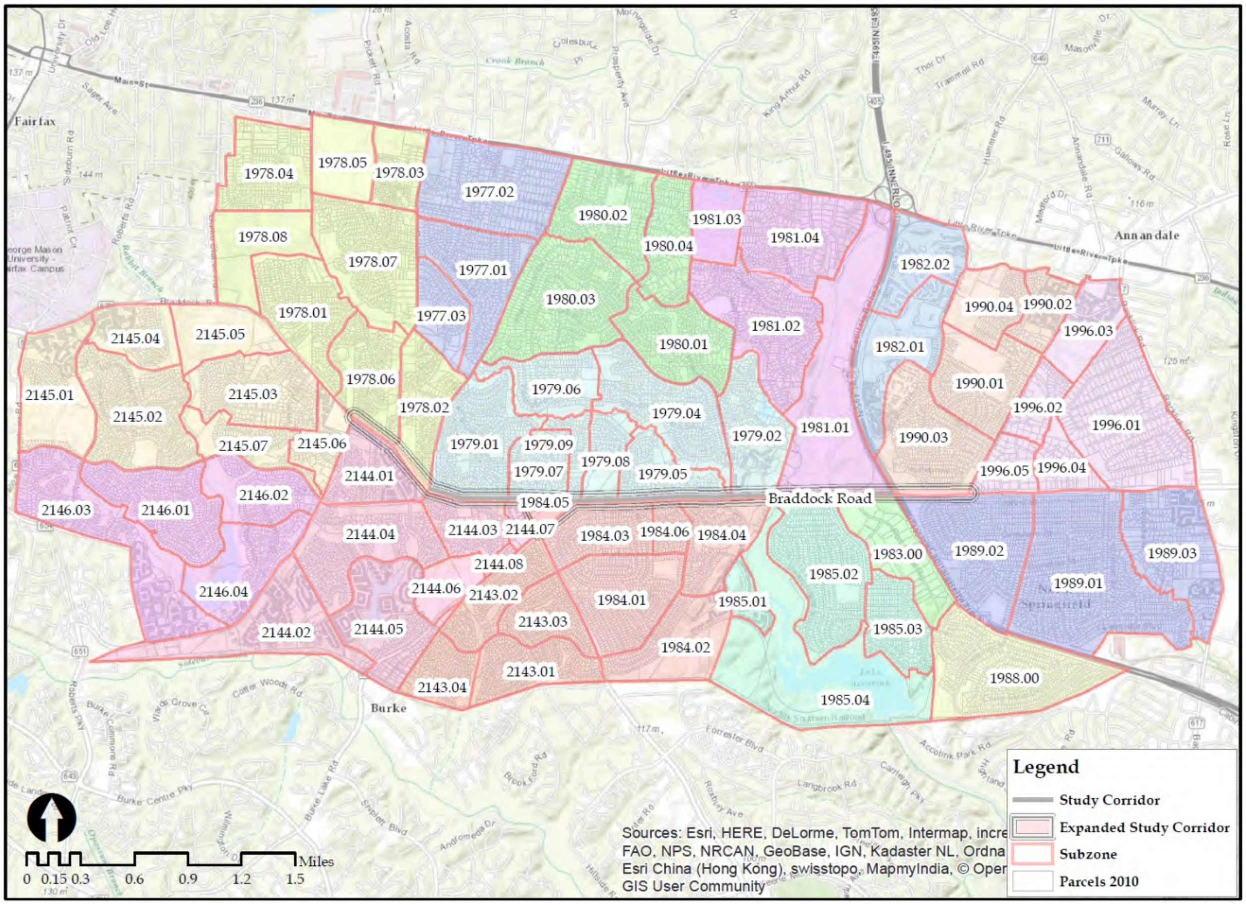


Figure 4-3: Study Area Transportation Analysis Zones (TAZ)

Figure 4-4 shows the overview of the Fairfax County process. The link between the TPB/MWCOG regional and the Fairfax County subzone models is through several regional model output files that serve as inputs to the Fairfax County Model. This process includes the procedure of splitting the TPB/MWCOG trip tables based on the subzone demographics such as households/population and employment.

The outputs from the Fairfax County Model include the network assigned with volumes for peak periods and level of service measures, and if specified, peak hour volumes for links and intersection level turn volumes and level of service measures. These measures can be used for post-processing and taken as inputs to the simulation software for detailed intersection analysis.

The Fairfax County Model was calibrated and validated at the county level. For this study, the model was validated for the base year 2015 and refined in the following ways:

- Review and refinement of the County Model TAZ structure to support the simulation analysis and the evaluation of impacts of different alternatives
- Development of land use data for the refined TAZ structure for the base and future years

- Highway network review and refinements based on the existing roadway conditions, compatibility with the enhanced TAZ structure, and support to the simulation analysis, with added detail in the study area; and

- Comparisons of estimated traffic volumes vs. observed traffic counts in the study area for the base year.

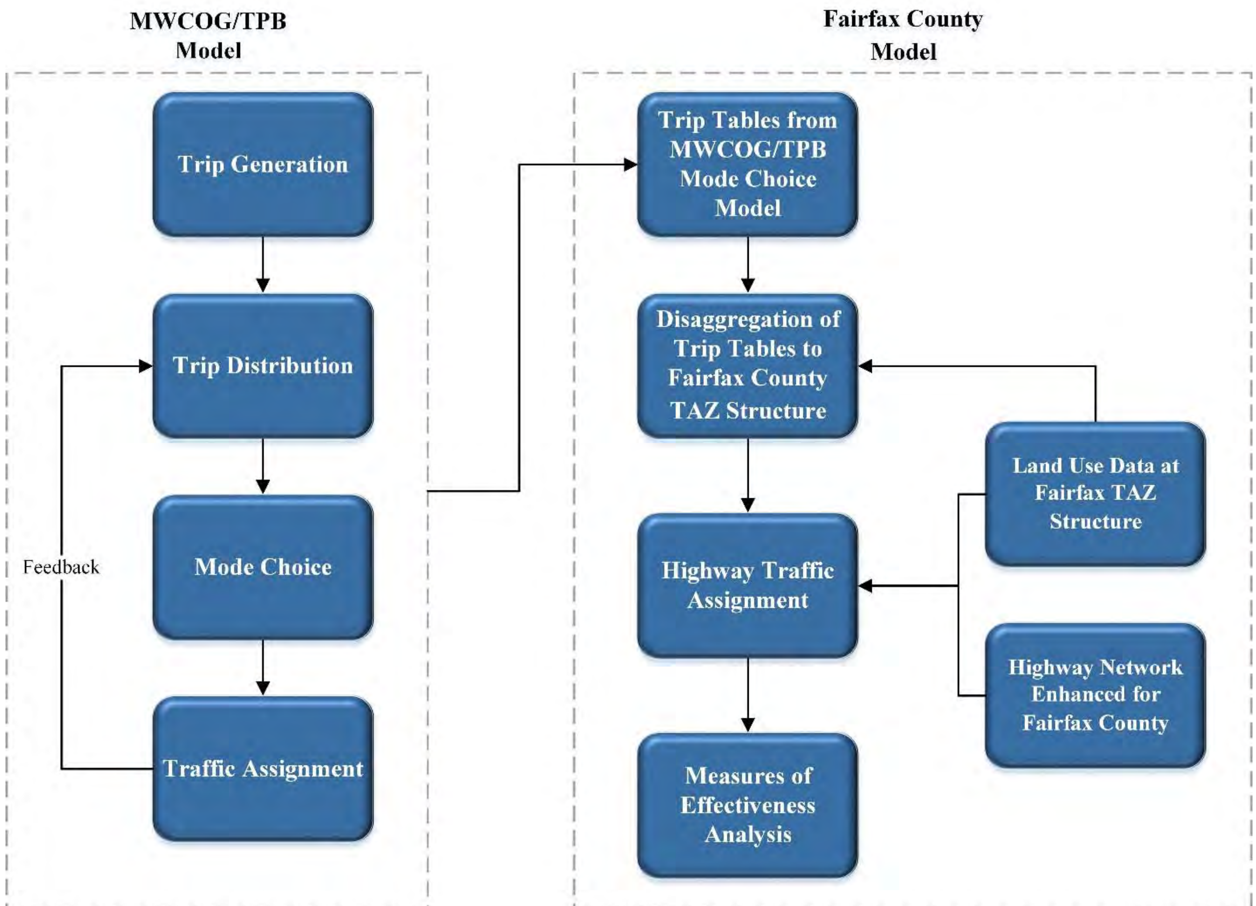


Figure 4-4: Fairfax County Model Structure

TAZ refinements considered major land use activities along the corridor and their access points/links, e.g., natural barriers (river), shopping centers and their access roads. The refined TAZ boundaries (see Figure 3) were created to align with parcel boundaries as much as possible. The land use data associated with the refined TAZ structure were developed by splitting the TPB/MWCOG land use data, based on the relative magnitude of land use activities at the parcel level in the study area.

The base year model network were enhanced to work with the enhanced TAZ structure, with added detail in the study area (see Figure 1). The validation year networks were also updated for compatibility with the future year base network being tested to ensure comparability of results, addressing centroid connector placement and/or link splits needed for future year networks. Additional local roads were coded to better reflect traffic circulation in the study area and help with the subsequent simulation.

Major enhancements in the networks include:

- Adding details to the study area, including all intersections, origins, and destinations identified for traffic simulation analysis;
- Refining centroid connectors to be compatible with the enhanced TAZ structure and splitting links to accommodate refined centroid connectors;
- Updating link attributes based on Synchro file and Google Aerials; and
- Refining coding of intersections based on existing configurations and proposed improvements, including coding of control devices.

E. Model Validation

The objective of model validation is to validate the performance of the base-year model in the study area so that the results are reasonable for use in the travel demand forecasting for a future year and for the evaluation of different alternatives. This entails development of a validation-year model run and use of it for checking of performance in the study area for reasonableness and introducing adjustments, if necessary. Model refinements focuses on network enhancements such as more accurate representation of traffic from a traffic analysis zone (TAZ) to the network via centroid connectors, added detail of network in the study area, and refined attributes of network links in the study area such as control devices, facility types, and turn lanes.

Validation and reasonableness checking involved reviewing count data compared to assignment volumes for cutlines in the study area. Cutlines are defined in **Figure 4-5**.

Table 4-1 shows the differences between model volumes and observed traffic counts for each of the five cutlines. The volumes are from the latest model run of Fairfax County travel demand model with the input highway network refined in the study area. The count data are based on the VDOT count data (Average Annual Weekly Daily Traffic – AAWDT) for the year of 2015. Reasonableness and locations of counts have been reviewed for the cutlines.

Overall, for the five cutlines in the Study Area, the model estimated volumes match the observed daily traffic reasonably well, with three percent deviation in total and thirteen or less percent deviation for each of the five cutlines. Specifically, for Cutline "East of I-495" intersecting Little River Turnpike and Braddock Rd east of I-495, estimated volumes are nearly ten percent lower than daily counts. To capture the difference between estimates and counts to the west of I-495, Cutline "West of I-495" has its estimated volumes roughly thirteen percent higher than the observed daily traffic. Cutline 'West" measures traffic entering the study area from the west, and its estimated volumes match the observed counts well, with only four percent deviation. All above three cutlines show that the model represents east-west traffic movements in the study area really well, with only one percent deviation between the model estimated and observed volumes.

Cutlines "North" and "South" demonstrate north-south traffic movements, each with estimated volumes matching the observed volumes really well. In aggregate, the model estimates deviate from the observed by only four percent for the north-south traffic movements.

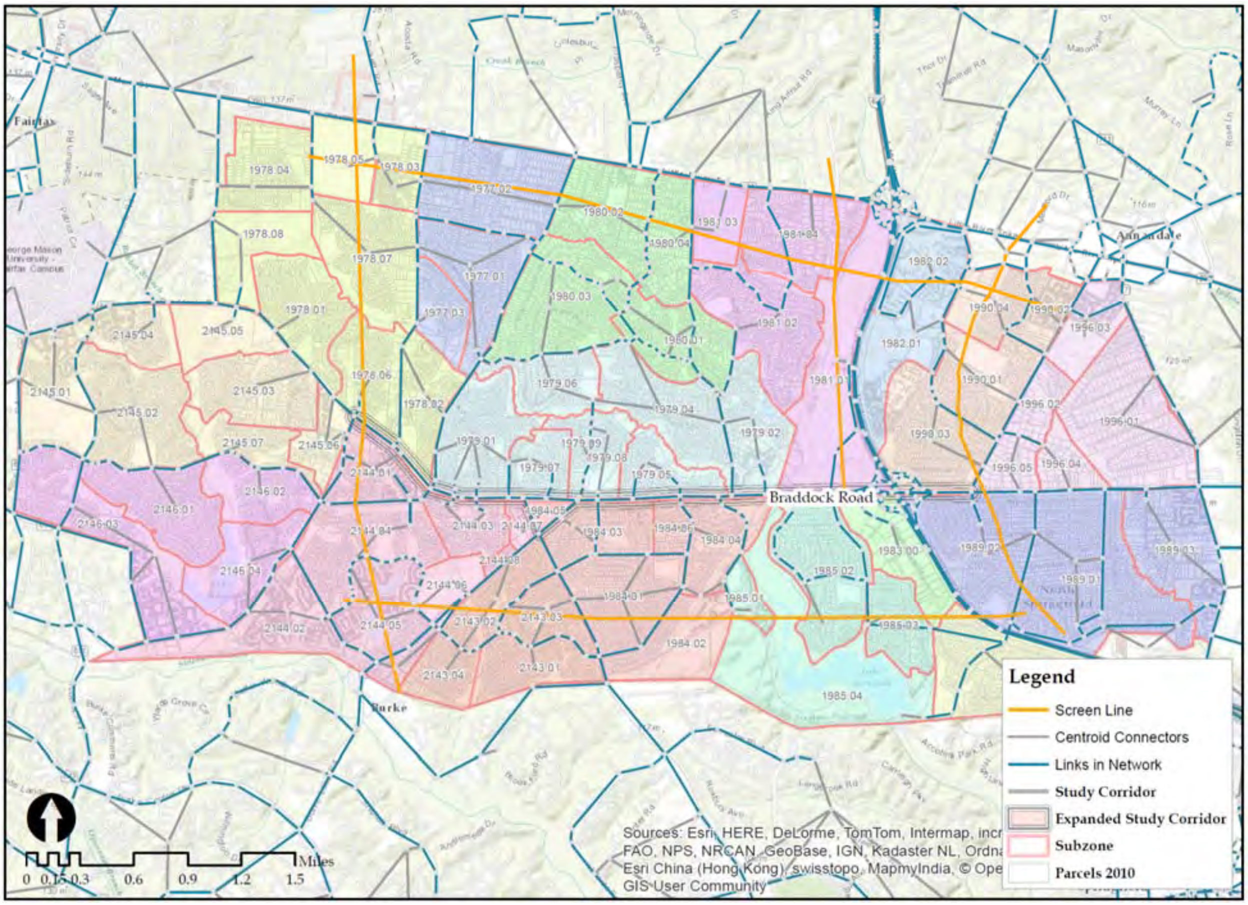


Figure 4-5: Cutlines in the Study Area

Cutlines	Observed Volumes (AAWDT)	Estimated Volumes	Percent Deviations	Percent Deviations (EW or NS
East of I-495	81,126	72,848	-10%	1% for NS Cutlines (EW movements)
West	109,430	105,230	-4%	
West of I 495	124,694	141,307	13%	
North	276,808	301,049	9%	4% for EW Cutlines (NS movements)
South	282,621	282,904	0%	
Total	874,679	903,338	3%	

Table 4-1: Base Year 2015 Model Validation

F. Post-Processing Procedures

Post-processing is used to adjust the raw outputs that are produced by the travel demand forecasting model to account for model variations. Currently, the guide for post-processing travel demand model forecasts is based on the FHWA guidance published in April 2010 on application of travel demand and forecasting for National Environmental Policy Act (NEPA) studies, which cited use of the National Cooperative Highway Research Program (NCHRP) Report 255: Highway Traffic Data for Urbanized Area Project Planning and Design. The latest update to NCHRP 255 is NCHRP Report 765: Analytical Travel Forecasting Approaches for Project-Level Planning and Design, published in 2014. This report reiterates the need for refinements of travel demand model results for the project-level forecasting, including use of the NCHRP 255 procedures.

Post-processing is necessary because of the spatial and temporal limitations of the travel demand forecasting model. The highway network that is used in a travel demand model is a simplified representation of the actual roadway network and does not include all the roads, intersections or access points (e.g., curb cuts, driveways) in the actual roadway system. Therefore, the results produced from the assignment need to be adjusted to compensate for these missing roadways and over-assignment to certain links in the model. Post-processing also adjusts for capacity limitations which are not fully represented in the model.

The post-processing refinement that Cambridge Systematics currently employs applies a set of procedures as outlined in NCHRP Reports 255 and Report 765. The ratio and difference methods are the most commonly used of these. For most applications, the first step is to correct for model bias, based on the differences between the observed count data and the model output for the validation year. The differences in the count and model results are applied to the future-year forecasts in the form of absolute differences and/or ratios. The differences are computed as both an absolute (delta) and a percentage (ratio); the two can be averaged and used as adjustments.

The following procedure was used for processing of the model results, so as to generate the study area OD trip tables that can be used to conduct VISSIM simulation.

- The original observed OD table was developed based on a blue-tooth survey that RK&K performed and then adjusted and smoothed by HNTB, using the traffic counts collected in Spring 2015 and the Fratar process

- A similar dimension OD table was estimated using the base year 2015 Fairfax County model and horizon year 2040 Fairfax County model

- The growth between 2015 and 2040 trip tables was calculated in terms of absolute and percentage differences for AM and PM peak

- The marginal growth for each origin and each destination in terms of absolute and percentage differences was evaluated for reasonableness and were applied to the same origin and destination in the 2015 smoothed observed OD table.

- The estimated marginal for each origin and each destination using absolute and percentage difference were reviewed for their reasonableness, which determined the choice of using the growth ratio, absolute difference, or their averaging. If the growth ratios were too large, the method of absolute difference or the averaging method was used.

- The resulted marginal for each origin and each destination were used to generate the 2040 OD trip table, using the Fratar method. The seed matrix was the 2015 OD matrix.

G. Forecasting Under Different Alternatives

The Braddock Road Multimodal Study addressed multi-modal needs along the corridor, including bicycle and pedestrian, transit, and vehicle. The roadway alternatives include the following options:

- "No Build" option where no improvements are made, and the road is not widened.
- "Intersection and Corridor Improvements" option where spot improvements are made at intersections along Braddock Road, but the road is not widened.
- Widening with HOV lanes.
- Widening with general purpose lanes open to all traffic.

"Intersection and Corridor Improvements" alternative includes intersection and corridor Improvements:

- Guinea Road to Ravensworth Road
- Intersection and Corridor Improvements at various locations such as turn lanes
- Access management (intersection spacing, side street access) included such as right in/right out
- Complete bicycle/pedestrian paths

"Widening with HOV lanes" alternative includes

- HOV Lanes from Burke Lake Road to I-495
- General Purpose Lane widening (3 lanes) from Guinea Road to Burke Lake Road
- Intersection and Corridor Improvements and access management

"Widening with general purpose lanes" alternative includes

- General purpose lanes from Burke Lake Road to I-495 (4 lanes) and Guinea Road to Burke Lake Road (3 lanes)
- One additional lane in each direction
- Includes Intersection and Corridor Improvements and access management

Land use forecasts in the study area remain the same under different alternatives. **Table 4-2** shows the growth of households, population, employment by categories (retail and non-retail), and total employment in the study area, in comparison with Fairfax County as a whole.

	Households	Population	Total Employment	Retail	Non-Retail
2015	24,100	72,500	11,900	1,500	10,400
2040	25,200	75,600	13,800	1,600	12,100
Study Area % Growth	5%	4%	16%	7%	17%
County % Growth	27%	23%	34%	20%	37%

Table 4-2: 2015 and 2040 Land Use in Study Area

Traffic forecasts show moderate growth between 2015 and 2040 in the origin and destination locations in the study corridor, with variated growth rates at different locations. Contributing factors for traffic growth along Braddock Road include the following:

- Total employment growth between 2015 and 2040 is approximately 16% in the study area, mostly concentrated in the commercial areas such as Ravenworth Shopping Center and Kings Park Shopping Center. Population growth between 2015 and 2040 is about 4%, concentrated primarily in west of Guinea Road.

- The Countywide growths between 2015 and 2040 are approximately 34% for total employment and 23% for population, which are much higher than the growth in the study area. The growth west of the study area is also higher than the study area, and especially the George Masson University areas are forecast to grow by 28% in total employment between 2015 and 2040.

- Transportation improvements such as capacity expansion on Capital Beltway NB and Little River Turnpike attract traffic and change traffic patterns. Little River Turnpike would have a much higher growth than Braddock Road, where congestion would limit future growth. Little River Turnpike would especially divert the traffic through the north-south roadways in the study area, e.g., Guinea Road, Wakefield Chapel Road, and Rolling Road. For example, the north-bound AM traffic on Guinea Road that heads north and east of the Little River Turnpike area would divert to Little River Turnpike from Braddock Road, and Guinea Road north of Braddock Road would attract traffic from Guinea Road south of Braddock Road and Rolling Road. Similarly, Little River Turnpike would also attract traffic via Wakefield Chapel Road. In addition, north bound Capital Beltway has added capacity north of the Braddock Road interchange and attract more traffic and change traffic patterns accordingly in the interchange area.

Build alternatives (HOV and GP widening) were forecast to induce more traffic in the corridor, and aggregate traffic increases at the origin and destination locations in the study corridor were in the magnitude of five percent during the AM and PM peak hours, with a wide variation among locations.

The 2040 origin-destination trip tables were developed for No Build, HOV and General Purpose Lane widening alternatives and used in the traffic simulation analysis. Intersection volumes were also post-processed and balanced for traffic analysis under different alternatives.

Analyses were also conducted on modal shares in the driveshed, drive access trips, and ridership for the proposed park-&-ride lots in the Kings Park Shopping Center and NOVA Training Center sites.

Chapter 5: Alternatives

The main goal of the Braddock Road Multimodal Study included developing and evaluating various improvement options for the study corridor. The improvement alternatives studied include:

- No-Build
- Intersection and Corridor Improvements
- HOV Outside Lanes Widening
- HOV Inside Lanes Widening
- General Purpose Lanes Widening

All improvement alternatives included the following bicycle and pedestrian improvements to the study corridor:

- A new Shared-use Path along both Eastbound and Westbound of Braddock Road
- New sidewalks
- Viable bicycle/pedestrian overpass (bridge) locations
- Improvements to the existing underpass at the Accotink Creek bridge.

Figure 5-1 below is a map of the Braddock Road study area that depicts the location of proposed improvements (highlighted in red).

Figure 5-1: Study Area Map

A. No-Build Alternative

i. Proposed Improvements

No improvements are proposed for the No-Build Alternative.

ii. Traffic Analysis

The 2040 No-Build Alternative O/D matrix followed the same format as Existing Conditions. The regional CLRP did not indicate any other improvements along the corridor other than those specific to this project. The 2040 No-Build AM and PM peak hour increase of traffic over Existing Conditions are shown in **Figure 5-2** and **Figure 5-3** for selected links. These links had large increases in traffic volumes and the growth of traffic was not consistent across the study area. Overall the study area traffic volumes for the 2040 No-Build Alternative increased nearly 18 and 11 percent for the AM and PM peak hours respectively.

Figure 5-2: 2040 No-Build Volume Growth from 2015 – AM Peak Hour

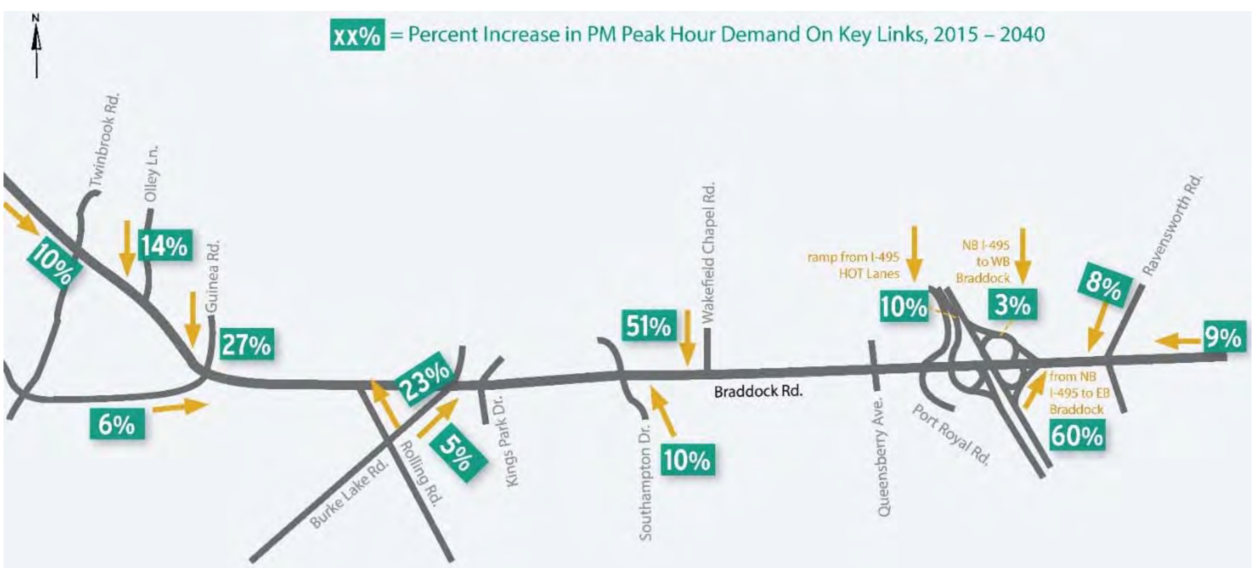


Figure 5-3: 2040 No-Build Volume Growth from 2015 – PM Peak Hour

<u>Alternative 1: 2040 Intersection and Corridor Improvements Alternative</u>

An O/D matrix was not developed for the Intersection and Corridor Improvements Alternative as it included spot improvements along the corridor and not corridor-wide capacity improvements. The regional travel demand model is not sensitive to spot improvements.

For microsimulation modeling, the O/D matrix for the Intersection and Corridor Improvements Alternative was developed from the No-Build O/D matrix as trips were reassigned to a different destination. For example, at the Burke Lake Road/ Grantham Street intersection, where eastbound left turns were prohibited, all destinations to that node were reassigned to turn left at Rolling Road to reach their destination (as these were end-point destinations). In other cases where a left turn was prohibited, the routing path was modified in VISSIM to reach the destination. For example, the Red Fox Drive “west” southbound left was prohibited. In this case, that traffic was rerouted to turn right to travel west and perform a U-turn maneuver to head eastbound, per their original path.

<u>Alternatives 2, 3 and 4: 2040 HOV and GP Widening Alternatives</u>

The HOV Inside and HOV Outside Alternatives used the same O/D matrix, as the travel demand model was not sensitive to whether the HOV lanes were on the inside or outside. The GP Widening Alternative had similar volumes to the HOV Alternatives but a separate O/D matrix. There were travel pattern changes from the No-Build/Intersection and Corridor Improvements Alternatives to these latter three Alternatives with the increased capacity for the corridor as shown in **Figure 5-4** and **Figure 5-5**.

Figure 5-4: Travel Pattern Change in Widening Alternatives over No-Build – AM Peak Hour

Figure 5-5: Travel Pattern Change in Widening Alternatives over No-Build – PM Peak Hour

Of the changes noted in the above figures, critical locations are as follows:

- AM peak hour
  - The eastbound/westbound Braddock Road movements to southbound I-495 combined total demand was forecasted to be over 2,500 vph in the AM peak hour (GP Widening, HOV Inside and HOV Outside scenarios). This is an increase of 1,000 vehicles (70 percent increase) over the No-Build Alternative. The demand exceeded the operational capacity of a single lane ramp.
  - The eastbound Braddock Road left turn volume to northbound Ravensworth Road increased by 100 vph (14 percent).
  - Northbound Guinea Road volumes increased by more than 300 vph (18 percent).
  - Northbound Olley Lane traffic volumes increased by approximately 180 vph (17 percent).
  - Northbound Wakefield Chapel Road volumes decreased by approximately 400 vph (40 percent).
  - Northbound Southampton Drive volumes decreased by approximately 100 vph (20 percent).
  - Northbound Burke Lake Road volumes decreased by approximately 140 vph (9 percent).
- PM peak hour
  - Northbound Guinea Road volumes increased by just over 100 vph (13 percent).
  - The eastbound/westbound Braddock Road movements to southbound I-495 combined total demand increased from 1,050 vph to nearly 1,700 vph, an increase of about 650 vph or 60 percent.
  - Southbound Ravensworth Road volumes increased by more than 100 vph (11 percent).
  - Northbound Wakefield Chapel Road volumes decreased by approximately 165 vph (nearly 30 percent)
  - Southbound Wakefield Chapel Road volumes decreased by approximately 200 vph (nearly 20 percent)

The 2040 O/D matrices and 2040 turn movement forecasts (peak hour volumes) for all the Alternatives can be found in Appendix J.

Analysis Summary: 2040 No-Build Alternative
The 2040 No-Build traffic volumes (AM and PM peak hours) were entered into the Existing Conditions Synchro models in order to develop optimized signal timings and offsets for the study area. These modified timings were transferred into VISSIM to detailed analysis. As indicated above, the CLRP did not indicate any improvements to the corridor. In the No-Build models, a crosswalk was added at the intersection of Braddock Road and Olley Lane after the Existing Conditions models were completed.

Table 5-1 presents the comparison of intersection MOEs between the Existing Conditions and the No Build Alternative. As traffic volumes increased for the No-Build Alternative, the intersections' level-of-service (LOS) deteriorated over the Existing Conditions. Detailed MOEs (delay and queues by intersection movements, and mainline travel times) are presented in Appendix L.

Alternative	Equivalent LOS					
	A	B	C	D	E	F
AM Peak Hour						
2015 Existing Conditions	0	0	5	3	5	0
2040 No-Build Alternative	0	0	0	0	1	12
PM Peak Hour						
2015 Existing Conditions	0	2	3	5	2	1
2040 No-Build Alternative	0	1	0	4	4	4

Table 5-1: Intersection LOS Summary

Key findings from the 2040 VISSIM analysis included:

AM Peak Hour
Traffic analysis for No-Build Alternative indicated that in 2040, traffic operations deteriorate significantly. Twelve intersections out of the 13 intersections in the study corridor operated at LOS F in 2040 No-Build Alternative while in Existing Conditions there were no intersections at LOS F.
Eastbound Direction

- There were multiple contributing factors to the congestion in the eastbound direction. These factors contributed to the increase of end-to-end travel time from approximately 13 minutes in Existing Conditions to over 37 minutes in the No-Build Alternative, an increase of over 180 percent. The corridor was congested end to end as one bottleneck blends into the next. Factors include:
  - The eastbound left turn demand at Ravensworth Road was above capacity for a single left turn lane, and this spilled back to Queensberry Avenue; which in turn trickled back to Wakefield Chapel Road.
  - The eastbound left turn traffic at Wakefield Chapel Road spilled back into the through lane and impacted the through movement.
  - Signal optimization provided more green time to the heavy northbound right turning volume at Southampton Drive. However, it reduced the green time to the eastbound through movement on Braddock Road resulting in higher mainline delay.

- o Similarly, competing needs for northbound left turns and eastbound through movement at Rolling Road reduced the available green time to the eastbound through movement.

Westbound Direction

- The westbound right turn at Guinea Road was determined to be the bottleneck as this traffic must slowdown in the shared through-right lane traffic. The slowdown of the right turning traffic affected the westbound through movement at this intersection and spilled back beyond Burke Lake Road. The travel time increased from under 10 minutes in the Existing Conditions to over 22 minutes in the No-Build Alternative, an increase of more than 120 percent.

<u>PM Peak Hour</u>
For the PM peak hour, the analysis indicated that eight intersections operated at LOS E or worse compared to three in Existing Conditions.
Eastbound Direction

- No operational deficiencies were noted in the eastbound direction. The change in the mainline travel time was negligible compared to the Existing Conditions.

Westbound Direction

- Several bottlenecks that were identified in the Existing Conditions still remained for the No-Build Alternative. Similar to PM Existing Conditions, each bottleneck blended onto the next. The westbound PM travel time increased from just under 15 minutes in Existing Conditions to over 25 minutes in the No-Build Alternative, an increase of nearly 70 percent.
  - o The westbound approach to Guinea Road spilled back to Burke Lake Road due to capacity constraints on the westbound approach.
  - o The increase in westbound left movement demand at Burke Lake Road resulted in maximum queues that reached Queensberry Avenue.
  - o The westbound queues at Port Royal Road were observed to impact the HOT lanes ramp regularly and reach the loop ramp from I-495 northbound occasionally.

iii. Impacts
  a. Property
     No Property Impacts

  b. Environmental
     No Environmental Impacts

iv. Stormwater Management and Drainage
  No Stormwater Management and Drainage improvements are proposed for the No-Build Alternative.

B. Bicycle and Pedestrian Accommodations

Along with the roadway improvements, bicycle and pedestrian improvements are proposed for all the build alternatives. Improvements include new a new Shared-use Path along both sides of Braddock Road, new sidewalks, HAWK signals (see below), viable bicycle and pedestrian overpass (bridge) locations, and Improvements to the existing bicycle and pedestrian path under the Accotink Creek bridge.

Shared-use Paths

Currently Braddock Road provides asphalt paths or sidewalks along various stretches of Braddock Road. The proposed improvements would replace or add all current asphalt paths and sidewalks along Braddock Road with a VDOT standard 10 foot wide Shared-use Path in both the Eastbound and Westbound direction. The proposed Shared-use Paths would begin at the Guinea Road intersection and end at the Port Royal Road intersection. A Shared-use Path is also proposed along the Northbound side of Danbury Forest Drive from the Braddock Road intersection to the existing Lake Accotink Trail approximately 400 feet from Lonsdale drive.

Sidewalks

The following are locations where new 5 foot wide sidewalks are proposed within the study area:

- Along Southbound Burke Lake Road from the Braddock Road intersection to the first Kings Park Shopping Center entrance across from Grantham Street (to replace existing asphalt path).
- Along Northbound Wakefield Chapel Road from the Braddock Road intersection to the existing sidewalk at the housing development. Along Southbound Wakefield Chapel Road from the Braddock Road intersection to the existing sidewalk at the Stahlway Lane intersection.

Both the Shared-use-path and sidewalk improvements along the Braddock Road will tie-into any existing side street sidewalks to help complete the missing pedestrian connections along the corridor.

HAWK Signals

Two HAWK (High-intensity Activated crossWalK) Beacons (signals) are proposed within the study corridor to create opportunities for a safer bicycle and pedestrian crossing in locations where a traffic signal is not proposed or warranted and an unsignalized bicycle and pedestrian crossing could be dangerous. One signal crosses Braddock Road in between Bradfield Drive and King David Boulevard/Dunleigh Drive (in front of St. Stephen’s United Methodist Church). Another signal crosses Burke Lake Road in between the Rolling Road intersection and the Grantham Street intersection.

Bicycle and Pedestrian Overpasses

Bicycle and Pedestrian overpasses would provide an elevated crossing alternative, that would not impact traffic flow at key intersections. Various locations for bicycle and pedestrian overpasses across Braddock Road were studied as viable alternatives. Three locations were chosen for potential overpass locations:

- Location 1: Across Braddock Road in between the Red Fox Drive (East) intersection and the Burke Lake Road/Woodland Way intersection.
- Location 2: Across Braddock Road in between the Kings Park Drive intersection and the Stone Haven Drive intersection.
- Location 3: Across Braddock Road in between the Southampton Drive intersection and the Wakefield Chapel Road intersection (closer to the Wakefield Chapel Road intersection).

Based on the community and Task Force meetings, Location 1 is the desired location and is included in the preferred alternative design. The other two locations are still potential locations that could be included in the improvement design.

Improvements to Existing Bicycle and Pedestrian Underpass

All improvement alternatives will include improvements to an existing bicycle and pedestrian path that runs perpendicular and underneath Braddock Road at the Accotink Creek bridge. Improvements include: lighting, ADA compliant ramp access from Braddock Road, and façade.

C. Intersection and Corridor Improvements Alternative

i. Proposed Improvements

The Intersection and Corridor Improvement Alternative proposes the improvement of various intersections within the study area. The improvement also includes realigning Braddock Road in the vicinity of the Braddock Road and Guinea Road intersection. The realignment would improve the safety of the intersection and provide a smoother curve along Braddock Road at the intersection. An additional through lane would be provided along Braddock Road Westbound from Rolling Road to Guinea Road. The additional through lane will terminate in the right lane of the dual left at the Braddock Road intersection with Guinea Road. An additional through lane is not proposed for Braddock Road Eastbound from Guinea Road to Rolling Road, two through lanes will continue to be utilized. **Figure 5-6** and **Figure 5-7** below are the proposed typical sections for the Intersection and Corridor Improvements Alternative. Proposed dimensions include:

- 12 foot wide lanes (where new lanes are proposed)
- 16 foot wide median (where applicable-face of curb to face of curb)
- 10 foot wide buffer from travel way to proposed Shared-Use-Path (where applicable)
- 10 foot wide proposed Shared-use Path
- 3 foot wide buffer from outside edge of Shared-use Path to proposed right-of-way

Note: The number of lanes varies within the corridor.

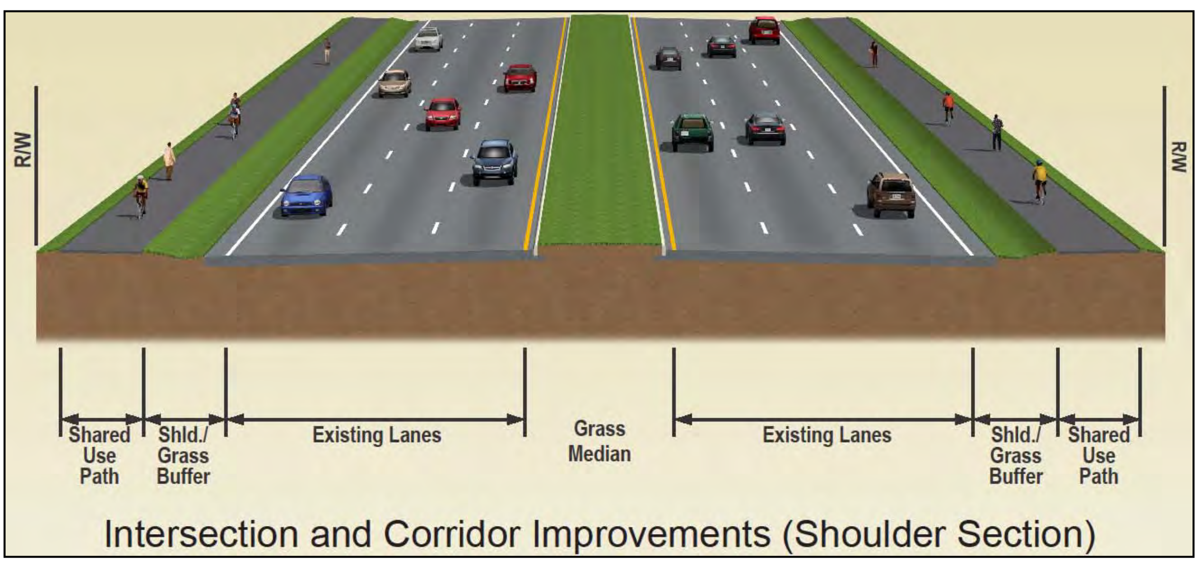


Figure 5-6

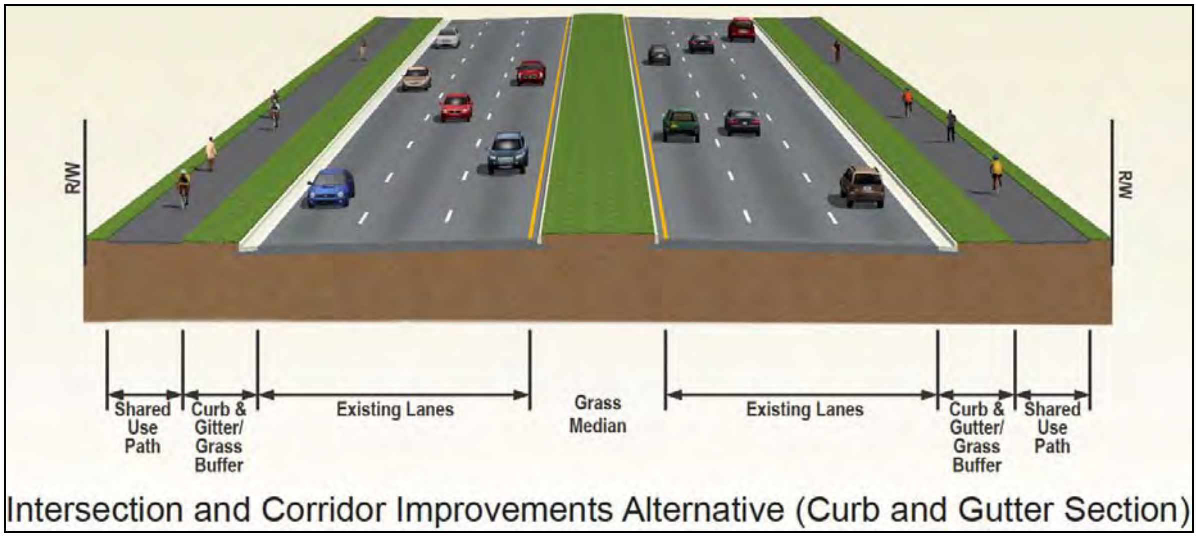


Figure 5-7

Figures 5-8(a-q) below present the existing and the proposed roadway configuration for each intersection. Also listed are the existing deficiencies of the intersection and the proposed Intersection and Corridor Improvements:

> Note: the existing traffic related deficiencies can be found in Chapter 3. The future traffic related deficiencies can be found in section "A. No-Build Alternative" of this chapter, see page 5-1.

Braddock Road at Guinea Road:

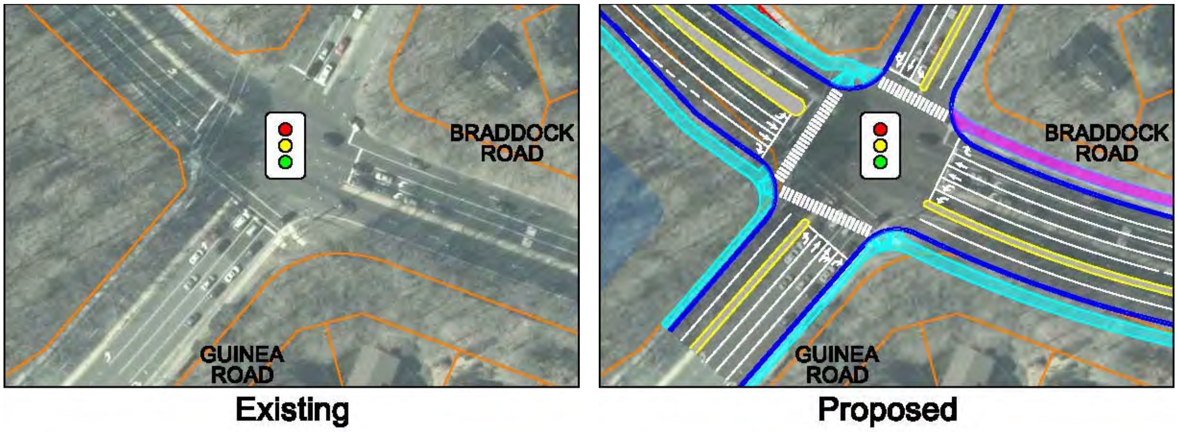


Figure 5-8a

Deficiencies

- Substandard curve radius through the intersection along Braddock Road

Improvements

- Realign Braddock Road through the intersection. Due to the realignment the entire intersection would shift to the South
- Northbound approach converted to left-turn, through, through-right, right-turn lanes (no additional pavement)
- Extend two-lane Northbound section north of intersection to Burnetta Drive
- Add right turn lane to Westbound Braddock Road turning on to Northbound Guinea Road

Braddock Road at Bradfield Drive:

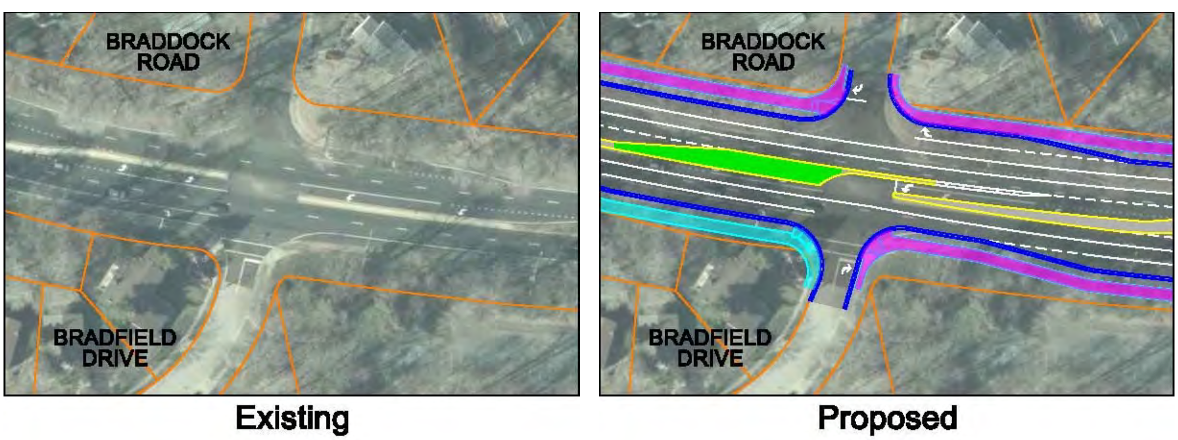


Figure 5-8b

Deficiencies

- Difficult and unsafe left turn movements from Bradfield Drive (north and south)

Improvements

- Restrict Bradfield Drive intersection to right in/right out both directions with channelized Braddock Road Westbound left-turn lane to Bradfield Southbound

Braddock Road at Dunleigh Drive/King David Blvd:

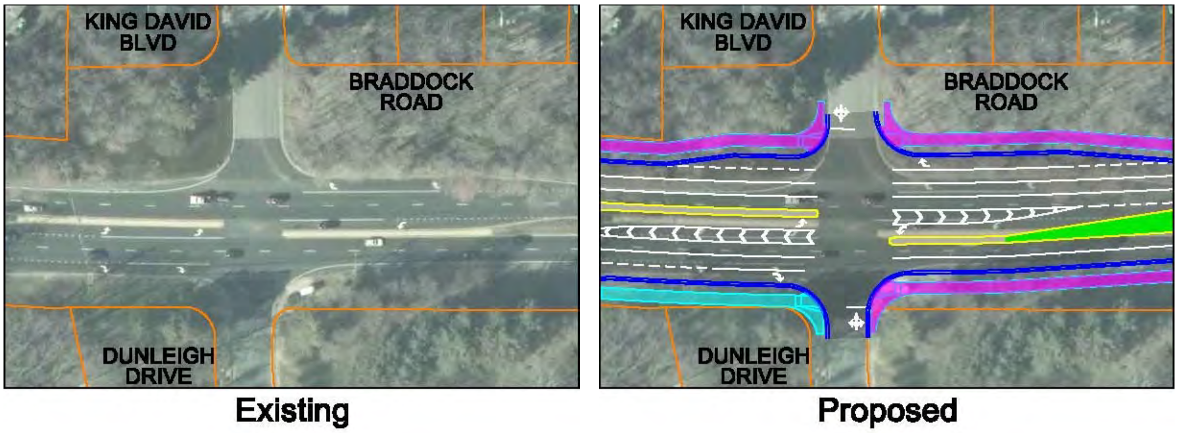


Figure 5-8c

Deficiencies

- o Difficult and unsafe left turn movements from both side streets and Braddock Road

Improvements

- o Within the vicinity of the intersection the median would be widened to 30 feet wide to provide a safe area for left turning vehicles from the side streets to stop in the median area

Braddock Road at Red Fox Drive (western connection):

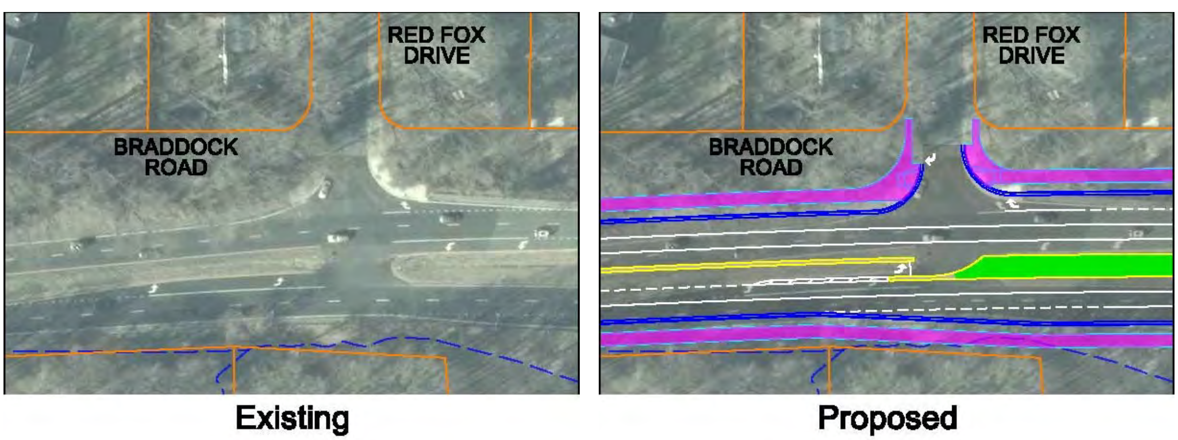


Figure 5-8d

Deficiencies

- o Difficult and unsafe left turn movement from Red Fox Drive

Improvements

- o Restrict Red Fox Drive (western connection) to right in/right out with channelized Braddock Road Eastbound left-turn lane to Red Fox Drive Northbound (western connection)

Braddock Road at Rolling Road:

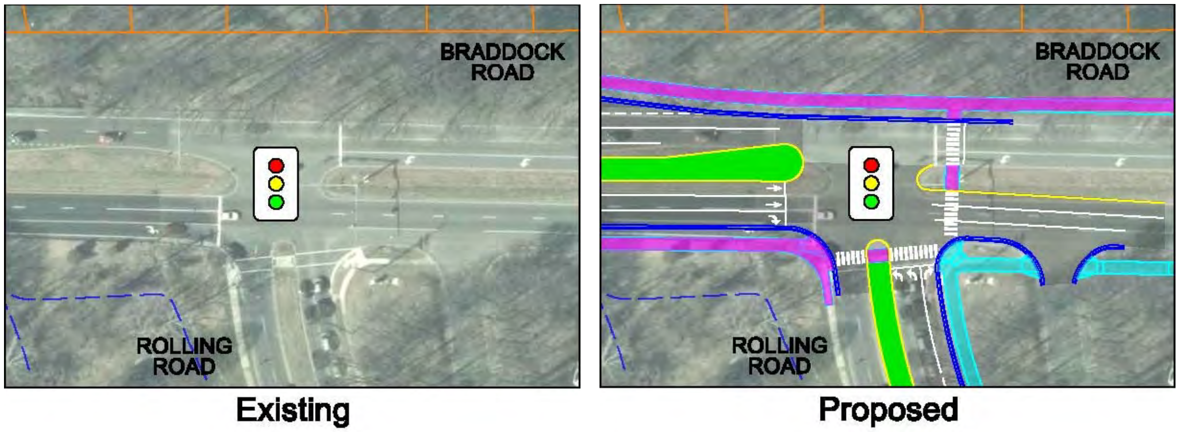


Figure 5-8e

Deficiencies

- o Insufficient left turn storage for Rolling Road Northbound turning onto Braddock Road Westbound

Improvements

- o Add right turn lane along Rolling Road Northbound and convert the existing right/left share lane along Rolling Road Northbound to left only

Burke Lake Road at Grantham Street:

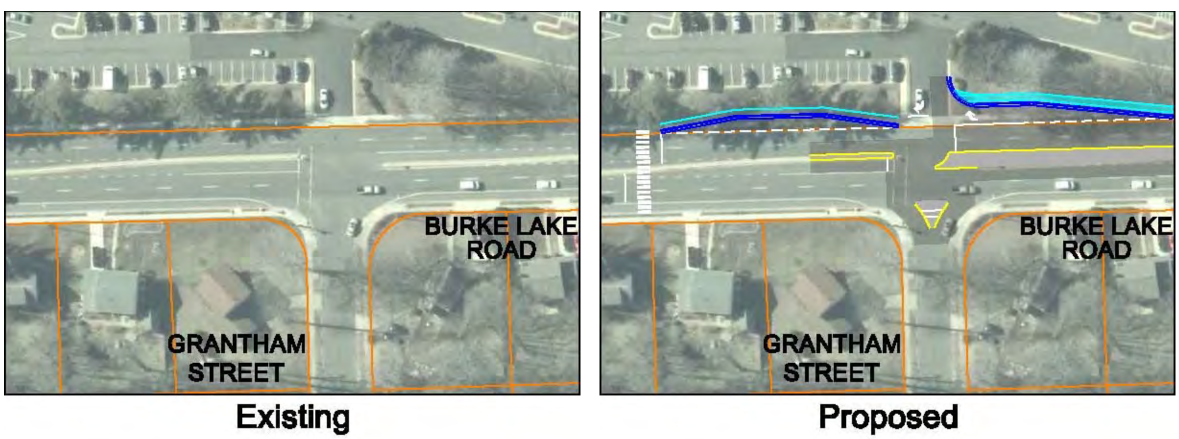


Figure 5-8f

Deficiencies

- o Difficult and unsafe left turn movement and through movement for Grantham Street and Kings Park Shopping Center entrance

Improvements

- o Restrict Grantham Street to right in/right out
- o Restrict shopping center drive to right in/right out with a left in from Burke Lake Northbound

Braddock Road at Burke Lake Road:

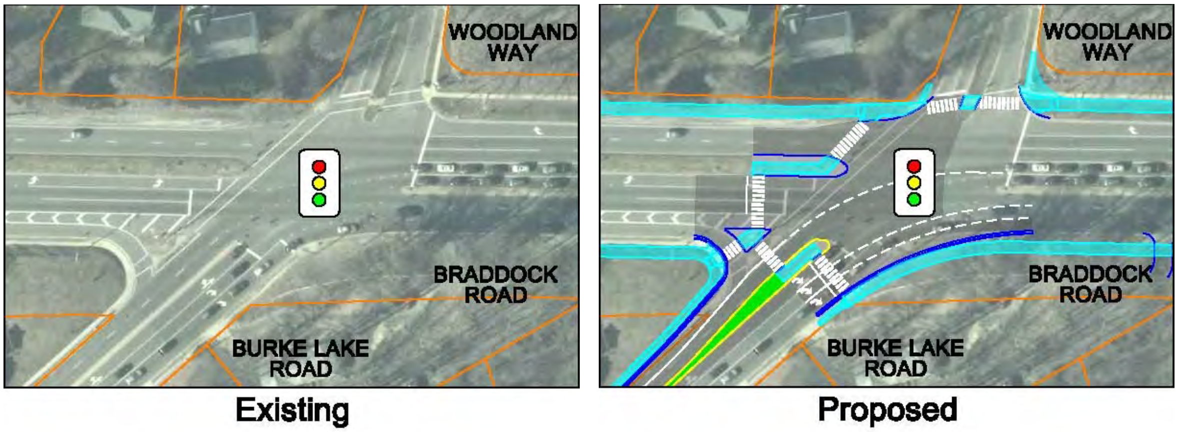


Figure 5-8g

Deficiencies

- o Insufficient right turn capacity for Burke Lake Road Northbound turning onto Braddock Road Eastbound

Improvements

- o Convert Northbound approach to triple right-turn only
- o Northbound right-turn-on-red prohibited
- o Extend Braddock Road Westbound dual left turns

Braddock Road at Kings Park Drive:

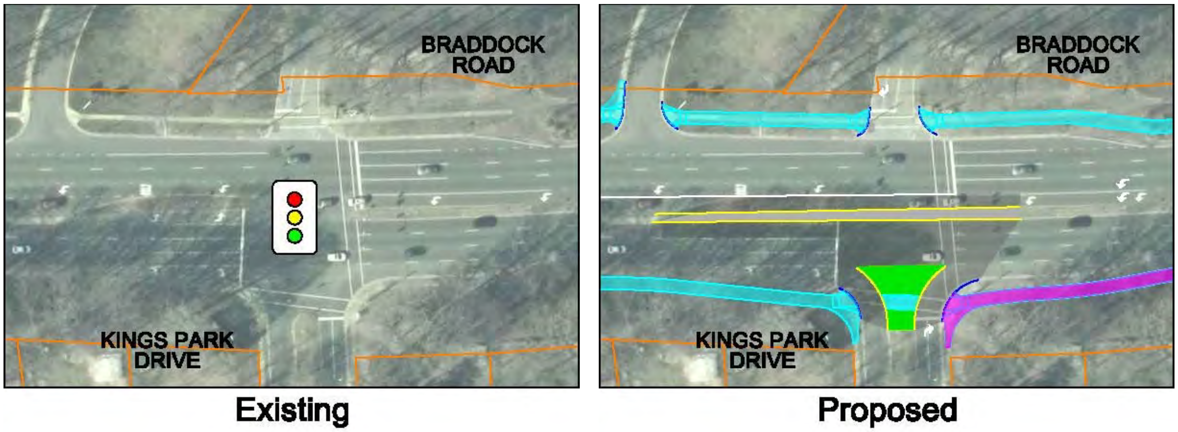


Figure 5-8h

Deficiencies

- o Insufficient left turn storage for Braddock Road Westbound turning onto Southbound Burke Lake Road

Improvements

- o Remove traffic signal
- o Extend Braddock Road Westbound dual left turns turning onto Southbound Burke Lake Road
- o Restrict Kings Park Drive to right in/right out by closing the median on Braddock Road
- o Restrict the Parkwood Baptist Church access to right in/right out by closing the median on Braddock Road

Braddock Road at Stone Haven Drive:

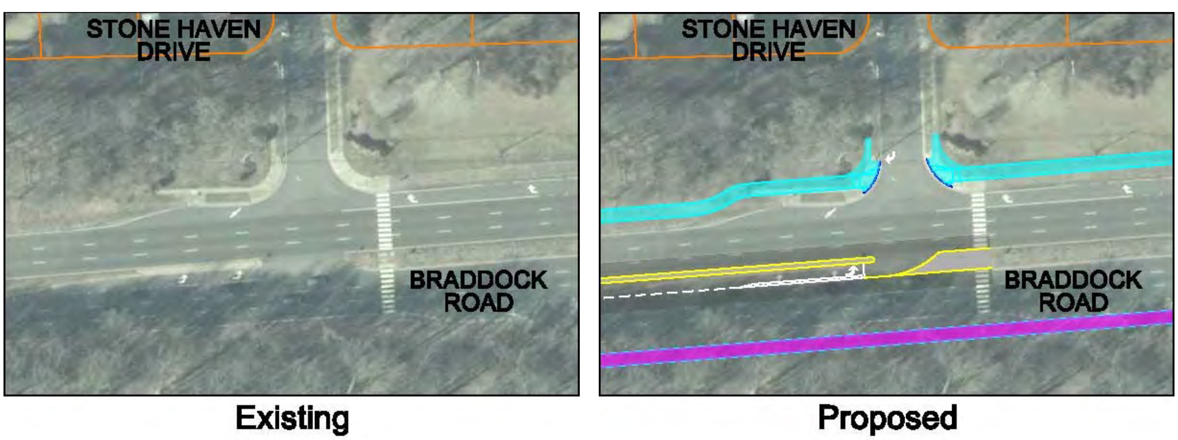


Figure 5-8i

Deficiencies

- o Difficult and unsafe left turn movement from Stone Haven Drive

Improvements

- o Restrict Stone Haven Drive to right in/right out with channelized Braddock Road Eastbound left-turn lane to Stone Haven Drive Northbound

Braddock Road at Southampton Drive:

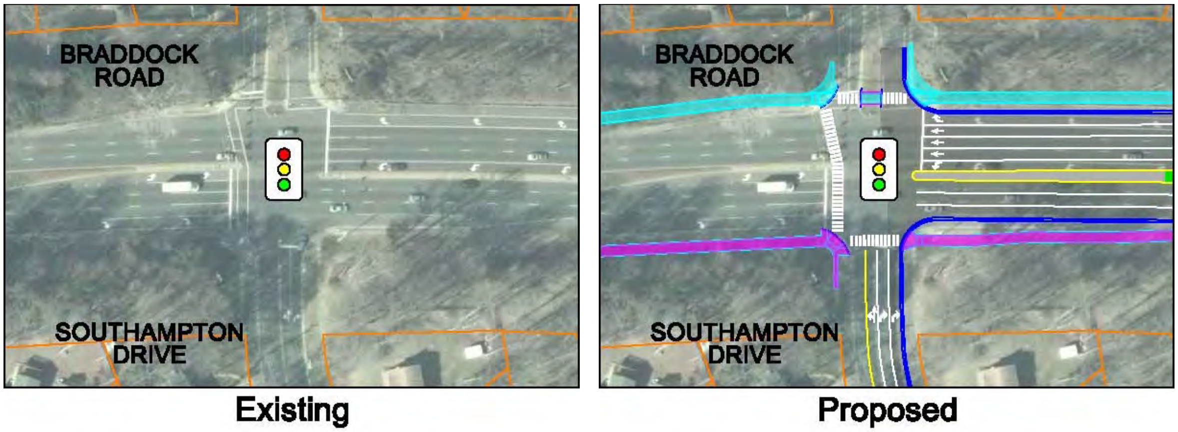


Figure 5-8j

Deficiencies

- Insufficient right turn capacity for Southampton Drive Northbound turning onto Eastbound Braddock Road

Improvements

- Add additional right turn lane to Southampton Drive Northbound turning onto Eastbound Braddock Road.

Braddock Road at Danbury Forest Drive/Wakefield Chapel Road (Conventional Intersection):

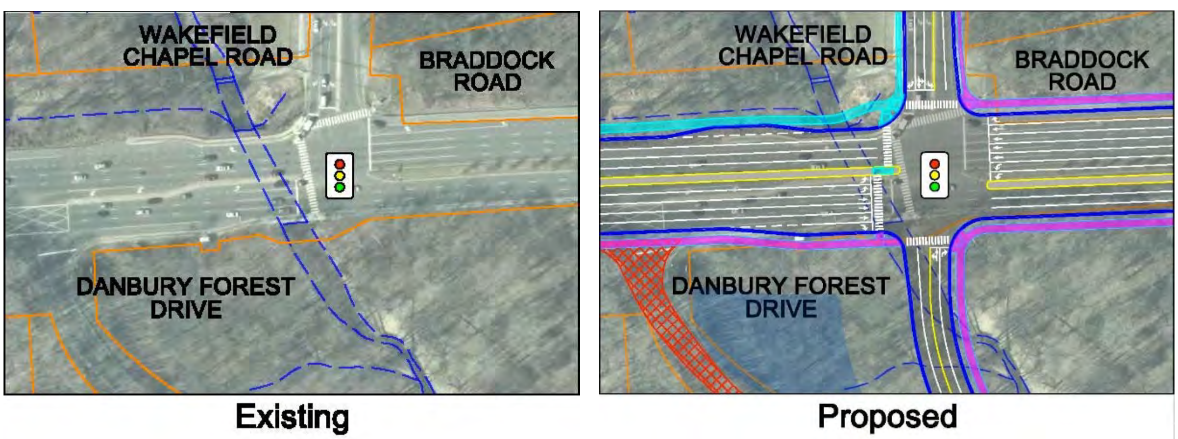


Figure 5-8k

Deficiencies

- The spacing for the Wakefield Chapel Road and Danbury Forest Drive intersections with Braddock Road is substandard

Improvements

- Realign Danbury Forest Drive to create a four-legged intersection with Wakefield Chapel Road
- Convert the Eastbound and Westbound left turn movements on Braddock Road to dual left-turn lanes

- Extend a second travel lane along Wakefield Chapel Road Northbound up to Stahlway Lane
- Danbury Forest Drive to be a four lane roadway until tying into the existing roadway

Braddock Road at Glen Park Road:

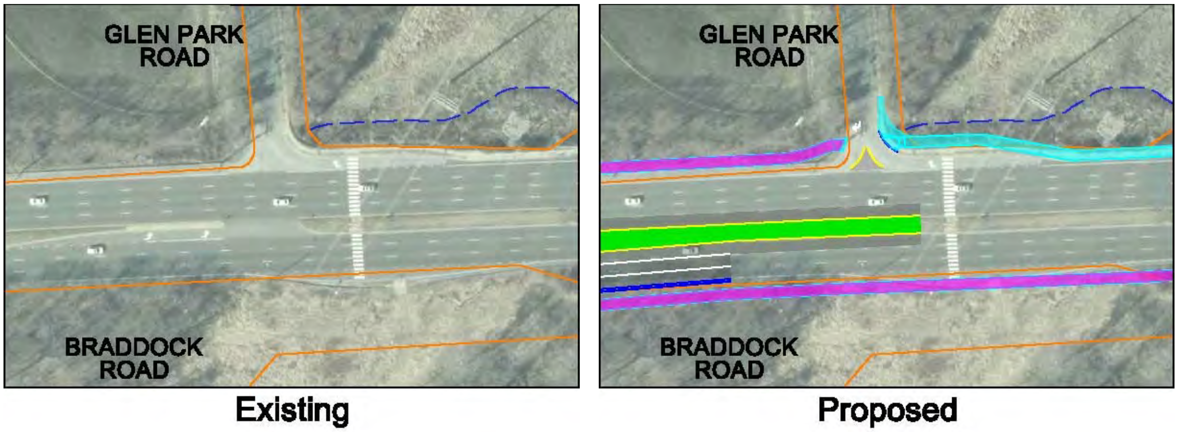


Figure 5-8l

Deficiencies

- Difficult and unsafe left turn movement from Glen Park Road

Improvements

- Restrict Glen Park Road to right in/right out by closing the median on Braddock Road

Braddock Road at Inverchapel Road:

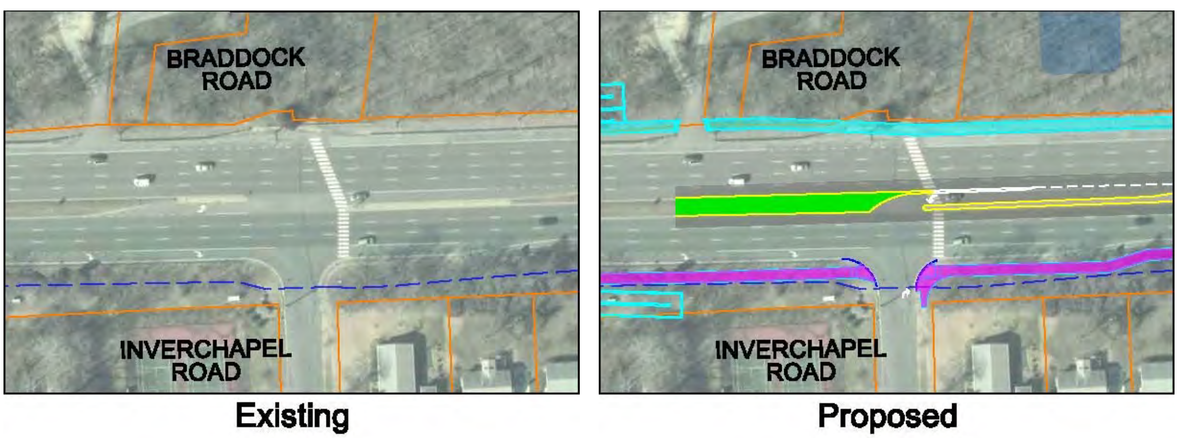


Figure 5-8m

Deficiencies

Difficult and unsafe left turn movement from Inverchapel Road

Improvements

- Restrict Inverchapel Road to right in/right out with channelized Braddock Road Westbound left-turn lane to Inverchapel Road Southbound

Braddock Road at Queensberry Avenue:

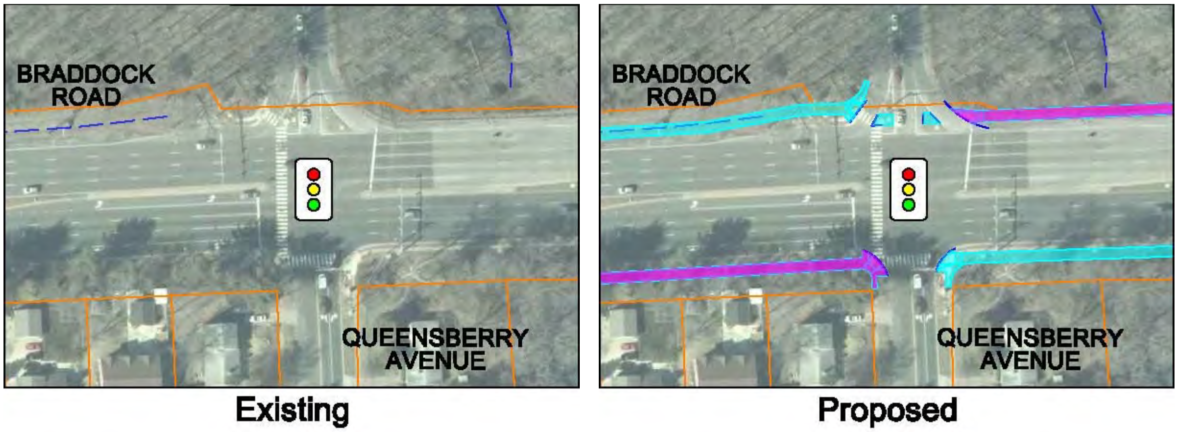


Figure 5-8n

- No Changes

Braddock Road at Port Royal Road/I-495 Southbound to Westbound exit ramp:

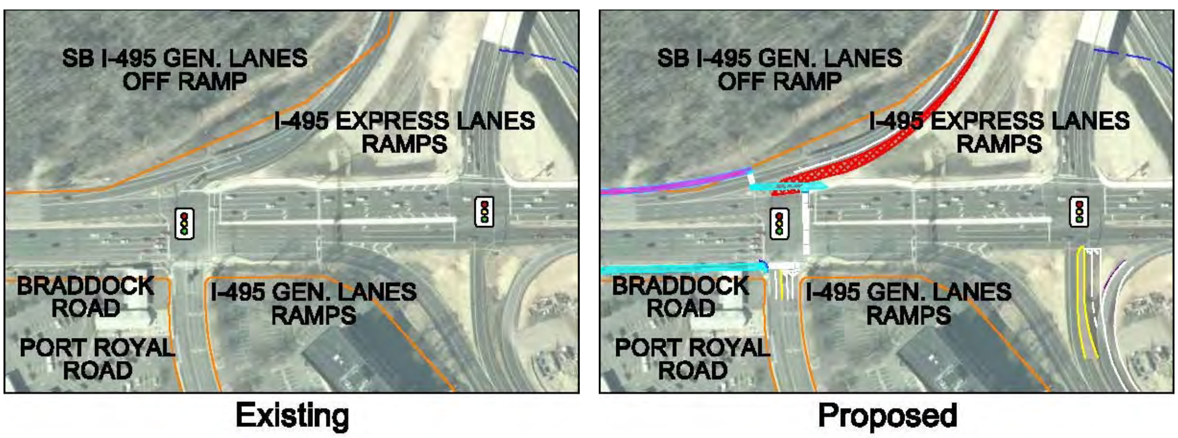


Figure 5-8o

Deficiencies

- I-495 Southbound exit ramp terminates at a signal

Improvements

- Eliminate movement from Southbound I-495 ramp to Port Royal Road
- Southbound I-495 Ramp to Port Royal Road traffic routed to SW quadrant with new left-turn ramp (dual left turn) at Braddock Road, then left-turn from Westbound Braddock Road to Port Royal Road (same movements can be used for access to Queensberry Avenue from Southbound I-495)
- Adequate signage to guide traffic to Port Royal Road and Queensberry Avenue from Southbound I-495

Braddock Road at I-495 Northbound to Eastbound Exit Ramp:

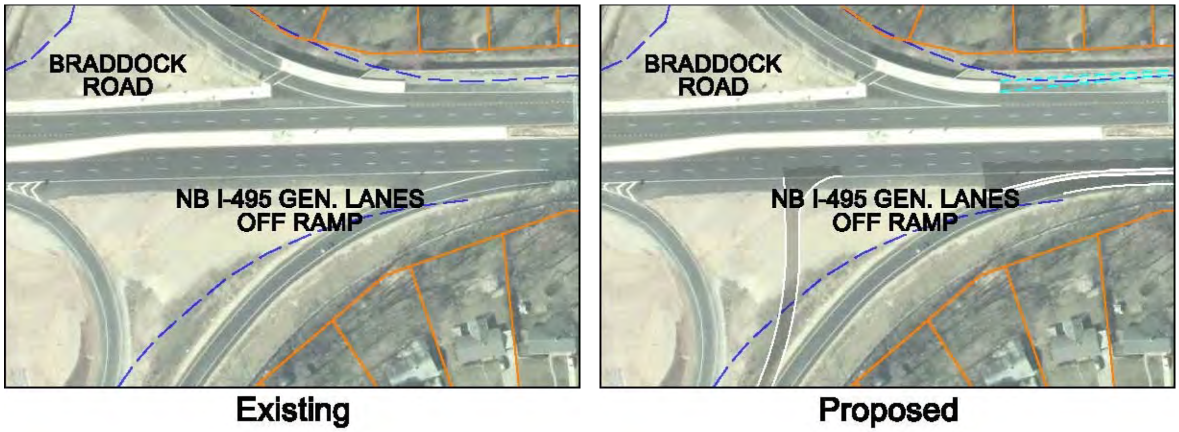


Figure 5-8p

Deficiencies

- o Difficult and unsafe merging from the I-495 general lanes off ramp to the left turn movement on Ravensworth Road Northbound

Improvements

- o Add a second ramp to create a more perpendicular intersection, creating additional weaving/storage distance along Braddock Road Eastbound turning on to Ravensworth Road Northbound

Braddock Road at Ravensworth Road:

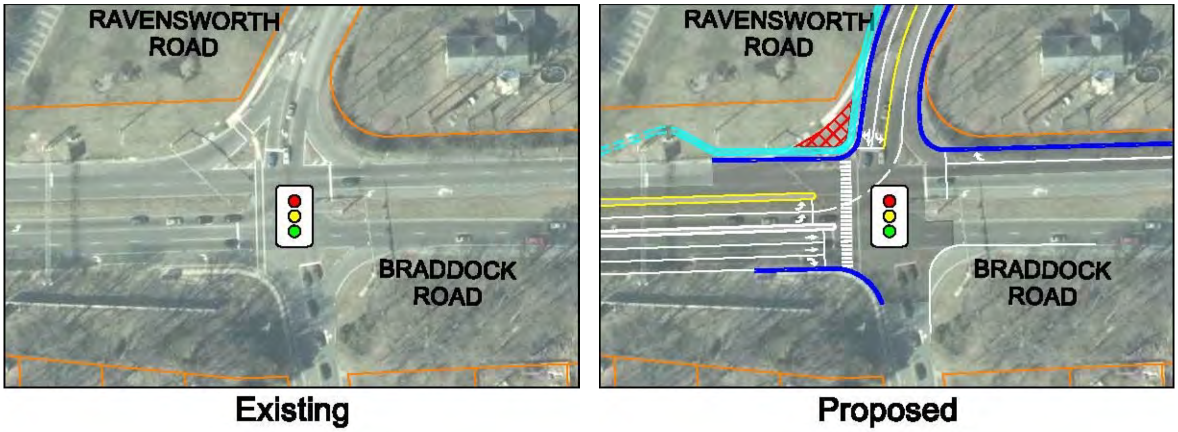


Figure 5-8q

Deficiencies

Insufficient left turn storage for Eastbound Braddock Road turning on Northbound Ravensworth Road

Improvements

- Convert Eastbound approach to dual left-turn lanes turning on to Ravensworth Road Northbound
- Create Northbound dual lanes along Ravensworth Road that merge together before Heritage Drive
- Eliminate the right turn slip lane on Ravensworth Road Southbound turning onto Braddock Road Eastbound
- Add left turn lane to Ravensworth Road Northbound turning onto Heritage Drive

See Appendix C for full size exhibits that depicts all improvements mentioned above.

ii. Impacts

a. Property

GIS-based right-of-way/parcel data shows that the proposed improvements will impact numerous private and public properties. A majority of the impacts are less than 0.1 Acres of right-of-way take. Temporary construction easement is required at most of the parcels in order to construction the tie-in slopes or construct retaining walls. The Intersection and Corridor Improvements alternative has the least property impacts of the build alternatives.

The only structural impact is a gas station canopy located at the intersection of Braddock Road and Port Royal Road. This impact could be avoided by reducing or eliminating the grass buffer between the back of curb and the proposed Shared-use Path.

Attached in Appendix D is a table that lists the conceptual level right-of-way takes and Temporary Construction Easement required for each of the build alternatives, except for HOV Outside Lanes which was dropped from consideration before the study's conclusion. (NOTE: minor geometric updates have been made after the MOEs were developed and the scoring was finalized by the Task Force/Technical

Team. These updates slightly altered the right-of-way impacts and Temporary Construction Easement required; there are still no building impacts).

b. Environmental

The proposed improvements will impact various environmental aspects along the Braddock Road corridor, the following summarizes the environmental impacts. Various trees along the side of the roadway will be impacted by the improvements. Due to the corridor running through a RPA (Resource Protection Area) the proposed improvements would impact the RPA along the roadway. Also within the RPA is the proposed realignment of Danbury Forest Drive, this improvement will extend the existing culvert along with relocation of a section of the stream that currently runs under Braddock Road located about one hundred feet West of the Braddock Road intersection with Wakefield Chapel Road. NOTE: Public improvement projects are exempt from RPA impact regulation (Chesapeake Bay Preservation Act); however, the County will avoid impacts where possible.

The environmental impacts are similar for the build alternatives. The only difference is the amount of trees impacted. The Intersection and Corridor Improvements alternative has the least amount of tree impacts (approximately 17 Acres) compared to the widening alternatives. The widening alternatives have similar tree impacts (approximately 23 Acres).

iii. Stormwater Management and Drainage

Sixteen main outfalls have been identified for this project.* Each outfall will require an independent analysis for water quantity. Thus, an SWM facility will likely be required at each outfall.* Additionally, project related impacts to existing SWM facilities will require compensation for the loss of the existing water quality benefits. Potential SWM facilities to satisfy water quality and quantity requirements will likely include infiltration, bioretention, swales, sand filters, constructed wetlands, wet ponds, extended detention ponds, and underground detention. A DEQ VSMP Construction General Permit will be issued through Fairfax County, and therefore, stormwater management will require compliance with Article 4 of the Fairfax County Stormwater Management Ordinance and Chapter 6 of the Public Facilities Manual, which are based on Part IIB criteria of the Virginia Administrative Code 9VAC25-870-62 et seq.

*NOTE: The SWM study reviewed only the Widening Alternatives which would have the most impact to the Braddock Road corridor. The Intersection and Corridor Improvements Alternative would have less impact to the Braddock Road Corridor.

D. Widening Alternative: HOV Outside Lanes

This Alternative was dropped from consideration before the study's conclusion due to operational issues

i. Proposed Improvements

The Widening Alternative: HOV Outside Lanes includes all of the Intersection and Corridor Improvements listed in Section C (Intersection and Corridor Improvements Alternative)* along with the addition of one through lane along Braddock Road in both directions. From Guinea Road to Burke Lake Road the current two lane section, in each direction (Eastbound & Westbound), will be widened to three lanes in each direction. From Burke Lake Road to I-495 the current three lane section along Eastbound Braddock Road will be widened to four lanes. From Burke Lake Road to I-495 the current three lane section along Westbound Braddock Road will be widened to four lanes, where applicable. Currently from Wakefield Chapel Road to I-495 Braddock Road Westbound is four lanes, no through lanes will be added along this section of Braddock Road Westbound. To help with operational issues at the Braddock Road and I-495 interchange all widening alternatives will extend the entrance ramp for the Southbound I-495 to the bridge at Heming Avenue. The HOV restrictions would only be applied along Braddock Road from the Burke Lake Road intersection to the I-495 interchange.

*NOTE: For this alternative the Braddock Road and Danbury Forest Drive/Wakefield Chapel Road intersection will use a Jug-handle configuration instead of the conventional configuration proposed for the Intersection and Corridor Improvements and General Purpose Widening alternatives. With the Jug-handle configuration the section of existing Danbury Forest Drive that is utilized for the jug-handle will not be available for tree or land mitigation as seen in the other alternatives. The Jug-handle configuration:

- Realign Danbury Forest Drive to meet Wakefield Chapel Road
- Left turns along Braddock Road at Wakefield Chapel Road/Danbury Forest Drive prohibited.
- Signal phasing will be three phase
- Preserve existing Danbury Forest Drive as a jug handle
- Braddock Road Westbound left turns use jug handle
- Braddock Road Eastbound left turns use jug handle

The outside through lane in each direction from Burke Lake Road to I-495 will be designated as an HOV lane. **Figure 5-9** below is the proposed typical section for the Widening Alternative: HOV Outside Lanes. Proposed dimensions include:

- 12 foot wide lanes
- 16 foot wide median (face of curb to face of curb)
- 10 foot wide buffer from travel way to proposed Shared-Use-Path (includes 2.5 foot wide curb and gutter)
- 10 foot wide proposed Shared-use Path
- 3 foot wide buffer from outside edge of Shared-use Path to proposed right-of-way

Note: The number of lanes varies within the corridor.

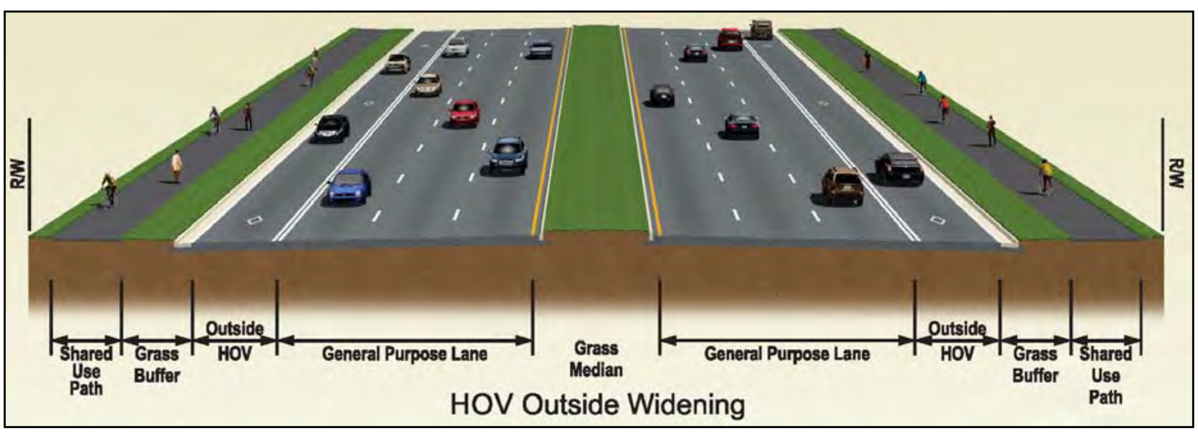


Figure 5-9

See Appendix B for full size exhibits that depicts all improvements mentioned above.

ii. Impacts

a. Property

GIS-based right-of-way/parcel data shows that the proposed improvements will impact numerous private and public properties. A majority of the impacts are less than 0.1 Acres of right-of-way take. Temporary construction easement is required at most of the parcels in order to construction the tie-in slopes or construct retaining walls. The widening alternatives (General Purpose and HOV alternatives) all have similar property impacts, the widening alternatives have more of an impact on properties compared to the Intersection and Corridor Improvements alternative.

The only structural impact is a gas station canopy located at the intersection of Braddock Road and Port Royal Road. This impact could be avoided by reducing or eliminating the grass buffer between the back of curb and the proposed Shared-use Path.

Attached in Appendix D is a table that lists the conceptual level right-of-way takes and Temporary Construction Easement required for each of the build alternatives, except for HOV Outside Lanes which was dropped from consideration before the study's conclusion. (NOTE: minor geometric updates have been made after the MOEs were developed and the scoring was finalized by the Task Force/Technical Team. These updates slightly altered the right-of-way impacts and Temporary Construction Easement required; there are still no building impacts).

b. Environmental

The proposed improvements will impact various environmental aspects along the Braddock Road corridor, the following summarizes the environmental impacts. Various trees along the side of the roadway will be impacted by the improvements. Due to the corridor running through a RPA (Resource Protection Area) the proposed improvements would impact the RPA along the roadway. Also within the RPA is the proposed realignment of Danbury Forest Drive, this improvement will extend the existing culvert along with relocation of a section of the stream that currently runs under Braddock Road located about one hundred feet West of the Braddock Road intersection with Wakefield Chapel Road. NOTE: Public improvement projects are exempt from RPA impact regulation (Chesapeake Bay Preservation Act); however, the County will avoid impacts where possible.

The environmental impacts are similar for the build alternatives. The only difference is the amount of trees impacted. The Intersection and Corridor Improvements alternative has the least amount of tree impacts (approximately 17 Acres) compared to the widening alternatives. The widening alternatives have similar tree impacts (approximately 23 Acres).

iii. Stormwater Management and Drainage

Sixteen main outfalls have been identified for this project.* Each outfall will require an independent analysis for water quantity. Thus, an SWM facility will likely be required at each outfall.* Additionally, project related impacts to existing SWM facilities will require compensation for the loss of the existing water quality benefits. Potential SWM facilities to satisfy water quality and quantity requirements will likely include infiltration, bioretention, swales, sand filters, constructed wetlands, wet ponds, extended detention ponds, and underground detention. A DEQ VSMP Construction General Permit will be issued through Fairfax County, and therefore, stormwater management will require compliance with Article 4 of the Fairfax County Stormwater Management Ordinance and Chapter 6 of the Public Facilities Manual, which are based on Part IIB criteria of the Virginia Administrative Code 9VAC25-870-62 et seq.

*NOTE: The SWM study reviewed only the Widening Alternatives which would have the most impact to the Braddock Road corridor. The Intersection and Corridor Improvements Alternative would have less impact to the Braddock Road Corridor.

E. Widening Alternative: HOV Inside Lanes

i. Proposed Improvements

The Widening Alternative: HOV Inside Lanes includes all of the Intersection and Corridor Improvements listed in Section C (Intersection and Corridor Improvements Alternative)* along with the addition of one through lane along Braddock Road in both directions. From Guinea Road to Burke Lake Road the current two lane section, in each direction (Eastbound & Westbound), will be widened to three lanes in each direction. From Burke Lake Road to I-495 the current three lane section along Eastbound Braddock Road will be widened to four lanes. From Burke Lake Road to I-495 the current three lane section along Westbound Braddock Road will be widened to four lanes, where applicable. Currently from Wakefield Chapel Road to I-495 Braddock Road Westbound is four lanes, no through lanes will be added along this section of Braddock Road Westbound. To help with operational issues at the Braddock Road and I-495 interchange all widening alternatives will extend the entrance ramp for the Southbound I-495 to the bridge at Heming Avenue. The HOV restrictions would only be applied along Braddock Road from the Burke Lake Road intersection to the I-495 interchange.

*NOTE: For this alternative the Braddock Road and Danbury Forest Drive/Wakefield Chapel Road intersection will use a Jug-handle configuration instead of the conventional configuration proposed for the Intersection and Corridor Improvements and General Purpose Widening alternatives. With the Jug-handle configuration the section of existing Danbury Forest Drive that is utilized for the jug-handle will not be available for tree or land mitigation as seen in the other alternatives. See the Proposed Improvements of the Widening Alternative: HOV Outside Lanes section of this chapter for the Jug-handle configuration details.

The inside through lane in each direction from Burke Lake Road to I-495 will be designated as an HOV lane. **Figure 5-10** below is the proposed typical section for the Widening Alternative: HOV Inside Lanes. Proposed dimensions include:

- 12 foot wide lanes
- 16 foot wide median (face of curb to face of curb)
- 10 foot wide buffer from travel way to proposed Shared-Use-Path (includes 2.5 foot wide curb and gutter)
- 10 foot wide proposed Shared-use Path
- 3 foot wide buffer from outside edge of Shared-use Path to proposed right-of-way

Note: The number of lanes varies within the corridor.

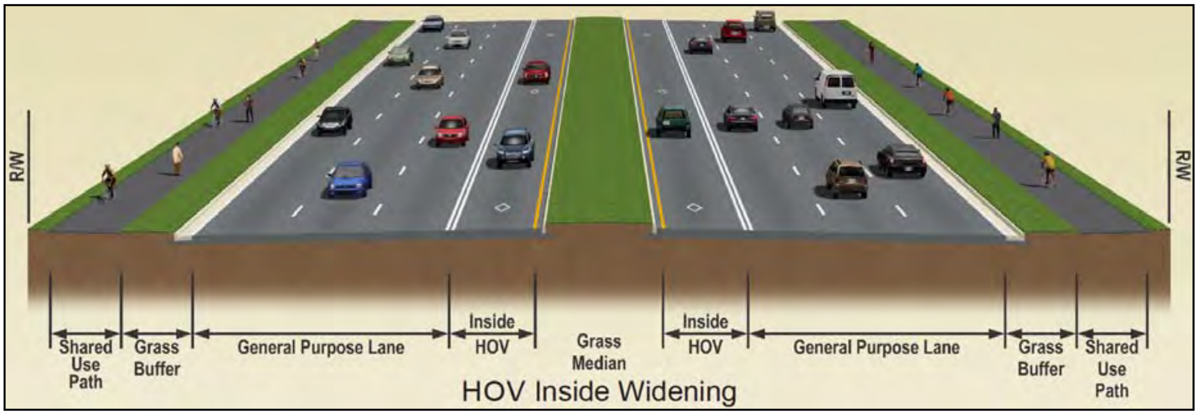


Figure 5-10

See Appendix B for full size exhibits that depicts all improvements mentioned above.

ii. Impacts

a. Property

GIS-based right-of-way/parcel data shows that the proposed improvements will impact numerous private and public properties. A majority of the impacts are less than 0.1 Acres of right-of-way take. Temporary construction easement is required at most of the parcels in order to construction the tie-in slopes or construct retaining walls. The widening alternatives (General Purpose and HOV alternatives) all have similar property impacts, the widening alternatives have more of an impact on properties compared to the Intersection and Corridor Improvements alternative.

The only structural impact is a gas station canopy located at the intersection of Braddock Road and Port Royal Road. This impact could be avoided by reducing or eliminating the grass buffer between the back of curb and the proposed Shared-use Path.

Attached in Appendix D is a table that lists the conceptual level right-of-way takes and Temporary Construction Easement required for each of the build alternatives, except for HOV Outside Lanes which was dropped from consideration before the study's conclusion. (NOTE: minor geometric updates have been made after the MOEs were developed and the scoring was finalized by the Task Force/Technical Team. These updates slightly altered the right-of-way impacts and Temporary Construction Easement required; there are still no building impacts).

b. Environmental

The proposed improvements will impact various environmental aspects along the Braddock Road corridor, the following summarizes the environmental impacts. Various trees along the side of the roadway will be impacted by the improvements. Due to the corridor running through a RPA (Resource Protection Area) the proposed improvements would impact the RPA along the roadway. Also within the RPA is the proposed realignment of Danbury Forest Drive, this improvement will extend the existing culvert along with relocation of a section of the stream that currently runs under Braddock Road located about one hundred feet West of the Braddock Road intersection with Wakefield Chapel Road. NOTE: Public improvement projects are exempt from RPA impact regulation (Chesapeake Bay Preservation Act); however, the County will avoid impacts where possible.

The environmental impacts are similar for the build alternatives. The only difference is the amount of trees impacted. The Intersection and Corridor Improvements alternative has the least amount of tree impacts (approximately 17 Acres) compared to the widening alternatives. The widening alternatives have similar tree impacts (approximately 23 Acres).

iii. Stormwater Management and Drainage

Sixteen main outfalls have been identified for this project.* Each outfall will require an independent analysis for water quantity. Thus, an SWM facility will likely be required at each outfall.* Additionally, project related impacts to existing SWM facilities will require compensation for the loss of the existing water quality benefits. Potential SWM facilities to satisfy water quality and quantity requirements will likely include infiltration, bioretention, swales, sand filters, constructed wetlands, wet ponds, extended detention ponds, and underground detention. A DEQ VSMP Construction General Permit will be issued through Fairfax County, and therefore, stormwater management will require compliance with Article 4 of the Fairfax County Stormwater Management Ordinance and Chapter 6 of the Public Facilities Manual, which are based on Part IIB criteria of the Virginia Administrative Code 9VAC25-870-62 et seq.

*NOTE: The SWM study reviewed only the Widening Alternatives which would have the most impact to the Braddock Road corridor. The Intersection and Corridor Improvements Alternative would have less impact to the Braddock Road Corridor.

F. Widening Alternative: General Purpose Lanes

i. Proposed Improvements

The Widening Alternative: General Purpose Lanes includes all of the Intersection and Corridor Improvements listed in Section C (Intersection and Corridor Improvements Alternative) along with the addition of one through lane along Braddock Road in both directions. From Guinea Road to Burke Lake Road the current two lane section, in each direction (Eastbound & Westbound), will be widened to three lanes in each direction. From Burke Lake Road to I-495 the current three lane section along Eastbound Braddock Road will be widened to four lanes. From Burke Lake Road to I-495 the current three lane section along Westbound Braddock Road will be widened to four lanes, where applicable. Currently from Wakefield Chapel Road to I-495 Braddock Road Westbound is four lanes, no through lanes will be added along this section of Braddock Road Westbound. To help with operational issues at the Braddock Road and I-495 interchange all widening alternatives will extend the entrance ramp for the Southbound I-495 to the bridge at Heming Avenue. **Figure 5-11** below is the proposed typical section for the Widening Alternative: General Purpose Lanes.

Proposed dimensions include:

- 12 foot wide lanes
- 16 foot wide median (face of curb to face of curb)
- 10 foot wide buffer from travel way to proposed Shared-Use-Path (includes 2.5 foot wide curb and gutter)
- 10 foot wide proposed Shared-use Path
- 3 foot wide buffer from outside edge of Shared-use Path to proposed right-of-way

Note: The number of lanes varies within the corridor.

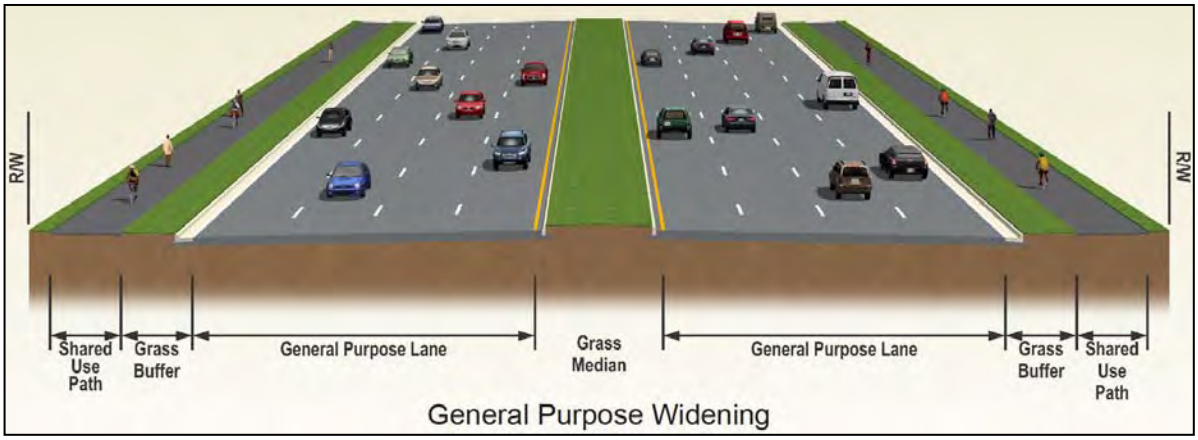


Figure 5-11

See Appendix B for full size exhibits that depicts all improvements mentioned above.

ii. Impacts

a. Property

GIS-based right-of-way/parcel data shows that the proposed improvements will impact numerous private and public properties. A majority of the impacts are less than 0.1 Acres of right-of-way take. Temporary construction easement is required at most of the parcels in order to construction the tie-in slopes or construct retaining walls. The widening alternatives (General Purpose and HOV alternatives) all have similar property impacts, the widening alternatives have more of an impact on properties compared to the Intersection and Corridor Improvements alternative.

The only structural impact is a gas station canopy located at the intersection of Braddock Road and Port Royal Road. This impact could be avoided by reducing or eliminating the grass buffer between the back of curb and the proposed Shared-use Path.

Attached in Appendix D is a table that lists the conceptual level right-of-way takes and Temporary Construction Easement required for each of the build alternatives, except for HOV Outside Lanes which was dropped from consideration before the study's conclusion. (NOTE: minor design updates have been made to the alternatives that may alter the right-of-way takes and Temporary Construction Easement required).

b. Environmental

The proposed improvements will impact various environmental aspects along the Braddock Road corridor, the following summarizes the environmental impacts. Various trees along the side of the roadway will be impacted by the improvements. Due to the corridor running through a RPA (Resource Protection Area) the proposed improvements would impact the RPA along the roadway. Also within the RPA is the proposed realignment of Danbury Forest Drive, this improvement will extend the existing culvert along with relocation of a section of the stream that currently runs under Braddock Road located about one hundred feet West of the Braddock Road intersection with Wakefield Chapel Road. NOTE: Public improvement projects are exempt from RPA impact regulation (Chesapeake Bay Preservation Act); however, the County will avoid impacts where possible.

The environmental impacts are similar for the build alternatives. The only difference is the amount of trees impacted. The Intersection and Corridor Improvements alternative has the least amount of tree impacts (approximately 17 Acres) compared to the widening alternatives. The widening alternatives have similar tree impacts (approximately 23 Acres).

iii. Stormwater Management and Drainage

Sixteen main outfalls have been identified for this project.* Each outfall will require an independent analysis for water quantity. Thus, an SWM facility will likely be required at each outfall.* Additionally, project related impacts to existing SWM facilities will require compensation for the loss of the existing water quality benefits. Potential SWM facilities to satisfy water quality and quantity requirements will likely include infiltration, bioretention, swales, sand filters, constructed wetlands, wet ponds, extended detention ponds, and underground detention. A DEQ VSMP Construction General Permit will be issued through Fairfax County, and therefore, stormwater management will require compliance with Article 4 of the Fairfax County Stormwater Management Ordinance and Chapter 6 of the Public Facilities Manual, which are based on Part IIB criteria of the Virginia Administrative Code 9VAC25-870-62 et seq.

*NOTE: The SWM study reviewed only the Widening Alternatives which would have the most impact to the Braddock Road corridor. The Intersection and Corridor Improvements Alternative would have less impact to the Braddock Road Corridor.

G. Future Year Build Traffic Analysis

For the Braddock Road Multimodal Study, four Alternatives were considered as follows:

- Intersection and Corridor Improvements
- High Occupancy Vehicles Inside (HOV Inside)
- High Occupancy Vehicles Outside (HOV Outside)
- General Purpose Widening (GP Widening)

Description of Alternatives

<u>Alternative 1: 2040 Intersection and Corridor Improvements Alternative</u>

The improvements incorporated into this alternative are presented by location:

1. Guinea Road:
   - Converted the right through lane into a shared through-right lane.
   - Added a westbound right turn bay.
   - Extended the second Guinea Road northbound through lane from Braddock Road to Burnetta Drive. This improvement provided a longer distance for the two lanes of northbound traffic to merge into a single lane.
2. Access management from Guinea Road to Rolling Road:
   - The eastbound left turns at Bradfield Drive were prohibited. These vehicles were assumed to travel eastbound and performed a U-turn at Red Fox Drive “west” and head westbound to turn right at Bradfield Drive.
   - The northbound left turns at Bradfield Drive were prohibited. These vehicles were assumed to turn right to travel eastbound on Braddock Road and perform a U-turn maneuver at the intersection with King David Boulevard to travel westbound.

- The southbound left turns at Bradfield Drive were prohibited. These vehicles were assumed to turn right to travel westbound on Braddock Road and perform a U-turn maneuver at the intersection with Guinea Road to travel eastbound.
- The southbound Red Fox Drive “west” left turns were prohibited. These vehicles were assumed to turn right to travel westbound on Braddock Road and perform a U-turn maneuver at the intersection with King David Boulevard to travel eastbound.

3. Restricted left turns at Burke Lake Road and Grantham Street:
   - Northbound Grantham Street left turns destined to westbound Burke Lake Road were assumed to exit the Kings Park neighborhood using Rolling Road. At this point, they would continue onto Rolling Road, or turn left onto Burke Lake Road based on their original destination.
   - Southbound left turns from the shopping center were rerouted to driveways along Rolling Road which turned left onto Burke Lake Road to travel eastbound towards their original destination.
   - Westbound Burke Lake Road left turns were reassigned to continue to travel on Burke Lake Road and turn right onto Rolling Road. These vehicles were assumed access Kings Park neighborhood from intersections along Rolling Road.
   - Eastbound left turns from Burke Lake Road into the shopping center were not affected.
4. Reconfigured intersection at Braddock Road and Burke Lake Road. Northbound through/left movements were eliminated with all (three) travel lanes as right turn only lanes. Through/left traffic was diverted to Rolling Road/Braddock Road intersection.
5. Closed median and remove signal at Kings Park Drive and thus allowing right-in/right-out turns only.
6. Closed median at Stone Haven Drive and thus allowing right-in/right-out turns only. Traffic was shifted to Southampton Drive.
7. Added a second northbound right turn lane on Southampton Drive and moved the east-leg bicycle and pedestrian crossing to the west-leg.
8. Two options were identified for Wakefield Chapel Road:
   - Jug-handle concept (**Figure 5-12**) where Danbury Forest Drive was realigned to Wakefield Chapel Road. The westbound left turns were accommodated at the “old” Danbury Forest Drive. The eastbound left turns were rerouted to turn onto “old” Danbury Forest Drive, then to “realigned” Danbury Forest Drive, and then travel northbound as a through movement to Wakefield Chapel Road.
   - Convectional intersection concept (**Figure 5-13**) where Danbury Forest Drive was realigned to Wakefield Chapel Road to create a conventional four-legged intersection.
   - Both options assumed a bicycle and pedestrian Bridge.

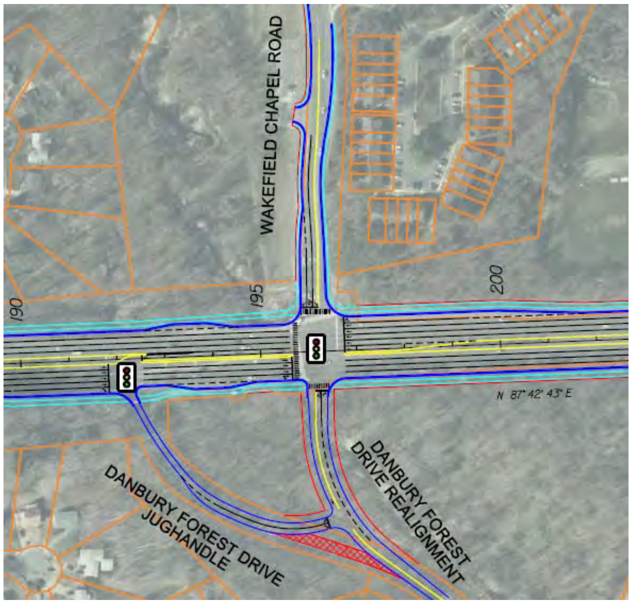


Figure 5-12: Jug-handle Concept

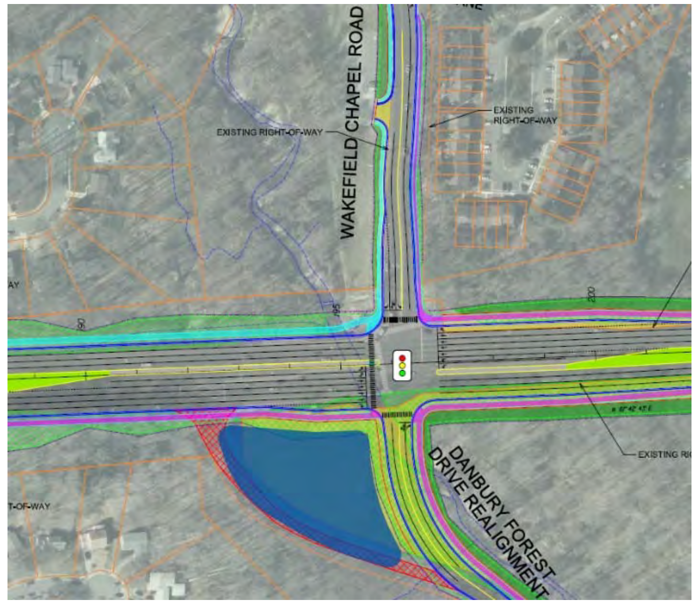


Figure 5-13: Conventional Intersection

9. Closed medians at Glen Park Road and Inverchapel Road and thus allowing right-in/right-out turns only.
10. Within the I-495 interchange (**Figure 5-14**), three improvements were identified and are shown in the following graphic:
    - Eliminated the southbound through movement (from I-495 off-ramp) to Port Royal Road. This traffic was moved to the southbound I-495 to eastbound Braddock Road loop ramp. This movement is accommodated through a northbound left-turn at the current HOT Lanes ramp intersection.
    - Reconfigured the northbound I-495 to eastbound ramp to be a hard-right turn onto Braddock Road to increase weaving distance to Ravensworth Road.

Figure 5-14: Braddock Road and I-495 Interchange

11. Two options for the on-ramp to southbound I-495 (Outer Loop):
    - Keep the Existing configuration: retained the one-lane merge onto southbound I-495

  - o Proposed configuration: widened the on-ramp merge to two lanes. Note that this improvement would require an Interchange Modification Report (not part of this project).

12. Added second eastbound left turn lane (nearly 1500 feet in length) from Braddock Road to northbound Ravensworth Road.

In addition to the Intersection and Corridor Improvements Alternative above, three widening Alternatives were also evaluated.

<u>Alternative 2: 2040 HOV Inside Alternative</u>
Integrated the improvements in Alternative 1 with two additional lanes designated as HOV-2 (two or more people in a vehicle) from I-495 to Burke Lake Road, and as general purpose (GP) from Burke Lake Road to Guinea Road. The HOV lanes were located on the inside/median side (left side in direction of travel) of the roadway. Key assumptions for the VISSIM analysis included:

- To turn left, GP traffic was permitted to cross the HOV lanes at designated locations in advance of the left turn bays.
- For the eastbound direction, the HOV lane was assumed to begin at Kings Park Drive and end at 300 feet beyond Queensberry Avenue. These limits were assumed to provide sufficient weaving distance in and out of HOV lane.
- For the westbound direction, the HOV lane was assumed to begin west of Port Royal Road and end 550 feet prior to Kings Park Drive. The large transition distance on the west side was assumed to provide sufficient distance for HOV traffic to weave across Braddock Road to access the left turn at Burke Lake Road.

<u>Alternatives 3: 2040 HOV Outside Alternative</u>

Integrated the improvements in Alternative 1 with two additional lanes, designated as HOV-2 from I-495 to Burke Lake Road, and as GP from Burke Lake Road to Guinea Road. The HOV lanes were located on the outside (right side in direction of travel) of the roadway. Key assumptions for the VISSIM analysis included:

- To turn right, GP traffic was permitted to cross the HOV lanes at designated locations in advance of the right turn bays.
- For the eastbound direction, the HOV lane was assumed to begin at Kings Park Drive and end at 300 feet beyond Queensberry Avenue. These limits were assumed to provide sufficient weaving distance in and out of the HOV lane.
- For the westbound direction, the HOV lanes were assumed to begin 300 feet prior to the intersection with Queensberry Avenue. This allowed the southbound I-495 off-ramp to weave into the GP lanes before the HOV lanes commenced. The HOV lane was assumed to end at Burke Lake Road.

<u>Alternatives 4: 2040 GP Widening Alternative</u>
Integrated the improvements in Alternative 1 with two additional lanes, as GP from I-495 to Guinea Road. Braddock Road would be eight lanes from I-495 to Burke Lake Road, then as six lanes from Burke Lake Road to Guinea Road.

<u>Transit Center</u>
The transit center was tested only with the GP Widening Alternative to create a standalone alternative. In comparing the GP Widening with and without the transit center, travel times along Braddock Road did not

differ, as the transit center did not remove a significant portion of the vehicular demand from the corridor. The purpose of the with and without the transit center, was to evaluate performance in and around the transit center. No operational deficiencies were noted at the transit center access points. The operations of the adjacent major intersections governed traffic flow along Braddock Road, Rolling Road and Burke Lake Road. Refer to the discussions under Final Configurations of the results of the Build Alternatives.

Scenarios Screening

In Alternative 1, improvements at locations 8 and 11 each had two identified options for consideration. As a result, these options had to be screened to identify the preferred roadway configuration of Braddock Road at these locations. The options were evaluated in permutation and as a result there were four scenarios for each alternative. All other improvements as identified above were incorporated into the four Build Alternatives. For the scenarios with a two-lane merge onto southbound I-495, only the AM peak hour was evaluated as the PM peak hour demand was below the capacity of a single lane ramp. The four scenarios are as follows:

- Scenario 1: Jughandle Intersection at Wakefield Chapel Road/Danbury Forest Drive with the existing one-lane merge onto southbound I-495 (AM and PM peak hours).
- Scenario 2: Jughandle with a widened two-lane merge onto southbound I-495 (AM peak hour only).
- Scenario 3: Conventional Intersection at Wakefield Chapel Road/Danbury Forest Drive with the existing one-lane merge onto southbound I-495 (AM and PM peak hours).
- Scenario 4: Jughandle with two-lane on-ramp to southbound I-495 (AM peak hour only).

The permutation resulted in 24 VISSIM models in total for the AM and PM peak hour conditions as shown in **Table 5-2**. Synchro was used to develop the optimized signal timings which were then incorporated into VISSIM. Findings of the scenarios screening are described below. Travel Time was the primary measurement to screen the scenarios.

Scenario Options	Alternatives			
	SI	HOV Inside	HOV Outside	GP Widening
Scenario 1	AM and PM	AM and PM	AM and PM	AM and PM
Scenario 2	AM only	AM only	AM only	AM only
Scenario 3	AM and PM	AM and PM	AM and PM	AM and PM
Scenario 4	AM only	AM only	AM only	AM only

Table 5-2: Sensitivity Testing

Scenario 1: Jug-handle Intersection with one-lane merge onto southbound I-495

This scenario assumed a Jug-handle configuration at the intersection with Wakefield Chapel Road and relocated Danbury Forest Drive, and retained the existing configuration of the one-lane merge onto southbound I-495.

AM Models

Eastbound Direction

- The existing lane-drop on the southbound I-495 ramp impacted operations for eastbound Braddock Road traffic for the HOV Inside & Outside, and GP Widening scenarios. These scenarios had a higher demand to the Outer Loop (southbound I-495) than the Intersection and Corridor Improvements scenario. The combined total demand for eastbound/westbound Braddock Road to southbound I-495 was over 2,500 vph in the AM peak hour (GP widening, HOV Inside and HOV Outside scenarios). This was above operational capacity of a single lane ramp. As the single-lane ramp was not able to accommodate the demand for these three scenarios, the traffic on the ramp spilled back onto Braddock Road. Note that for the Intersection and Corridor Improvements scenario, this demand was only 1,450 vph.

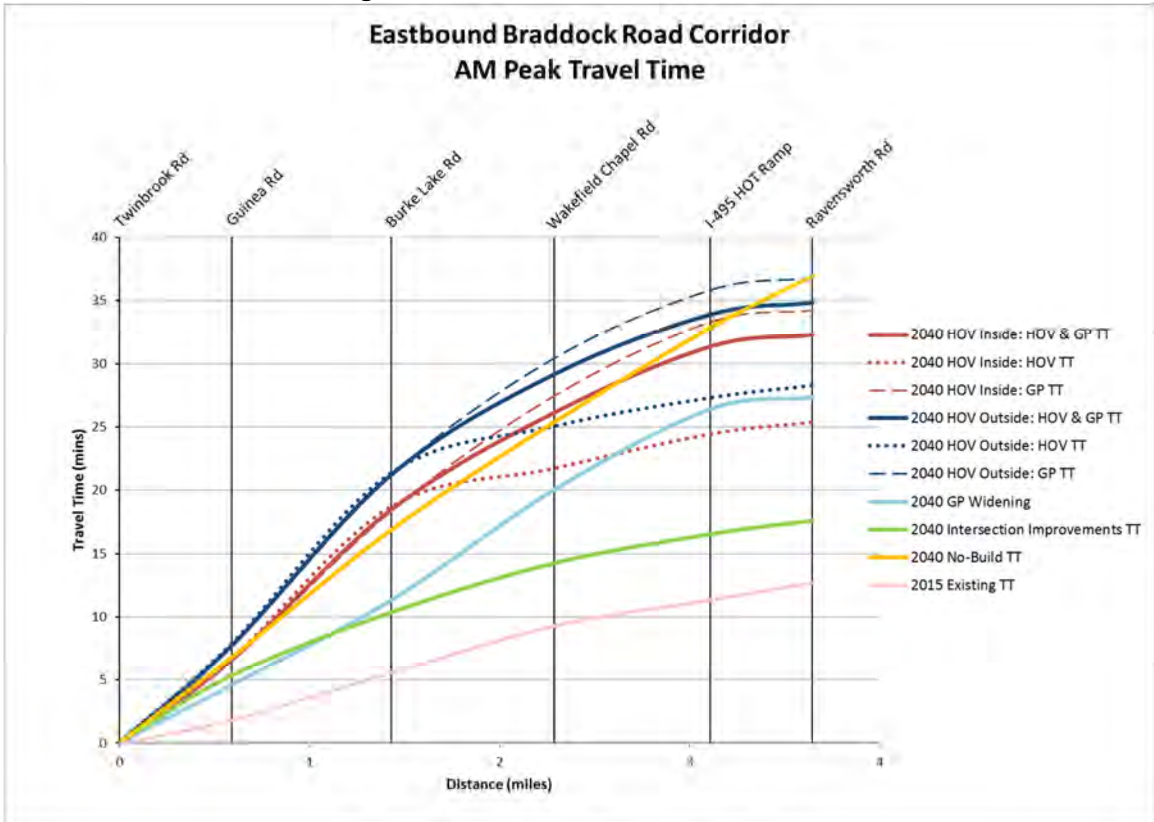
- Specific findings by Alternative under this scenario are discussed below:
  - Intersection and Corridor Improvements – in the eastbound direction, the segment of Southampton Drive to Wakefield Chapel Road continued to limit eastbound flow. This was in part due to the heavy southbound left turn demand at Wakefield Chapel Road that reduced green time to the eastbound through movement. The travel time was better for this Alternative than the other three, as the demand for the ramp to southbound I-495 was below the capacity of a single-lane ramp.
  - GP Widening – in the eastbound direction, the existing single-lane on-ramp to southbound was the bottleneck for the corridor.
  - HOV Inside – in the eastbound direction the one-lane merge onto southbound I-495 was the bottleneck for the corridor. Minor traffic turbulence occurred as HOV eligible vehicles exited the inside HOV lanes and weaved across the GP lanes to reach the northbound and southbound I-495 on-ramps.
  - HOV Outside – weaving difficulties at the end of the HOV lane created a bottleneck for eastbound Braddock Road traffic between Queensberry Avenue and Port Royal Road. HOV eligible vehicles destined to the I-495 Express Lanes must cross three lanes to the left to reach the turn lane for the I-495 Express Lanes. After the end of the HOV lane, all vehicles from GP lanes destined to southbound I-495 must weave across one or two lanes to reach the ramps to northbound and southbound I-495. This created turbulence in traffic flow.

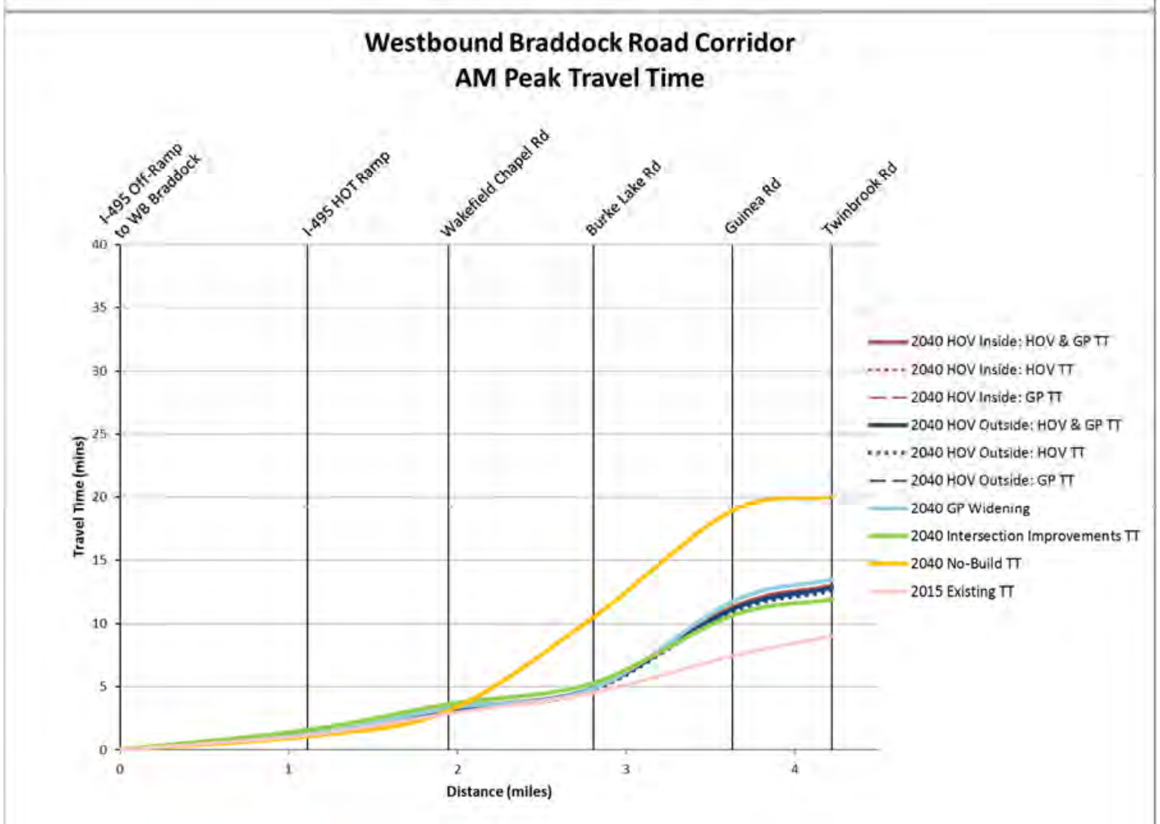
Westbound Direction

- There were no additional operational issues identified in the westbound direction as all the Build travel times were similar to Existing Conditions.
  - Guinea Road remained a bottleneck, however, the eastbound right turn bay reduced impacts at this location as identified in the No-Build Alternative.
  - The Intersection Improvement Alternative had a slightly better travel time compared to the other Build Alternatives as the demand for the corridor was lower.

The AM peak hour travel times for Scenario 1 in both eastbound and westbound directions, with a comparison to No-Build Alternative, are presented in **Figure 5-15**.

Figure 5-15: Scenario 1 AM Travel Time





PM Models

Eastbound Direction

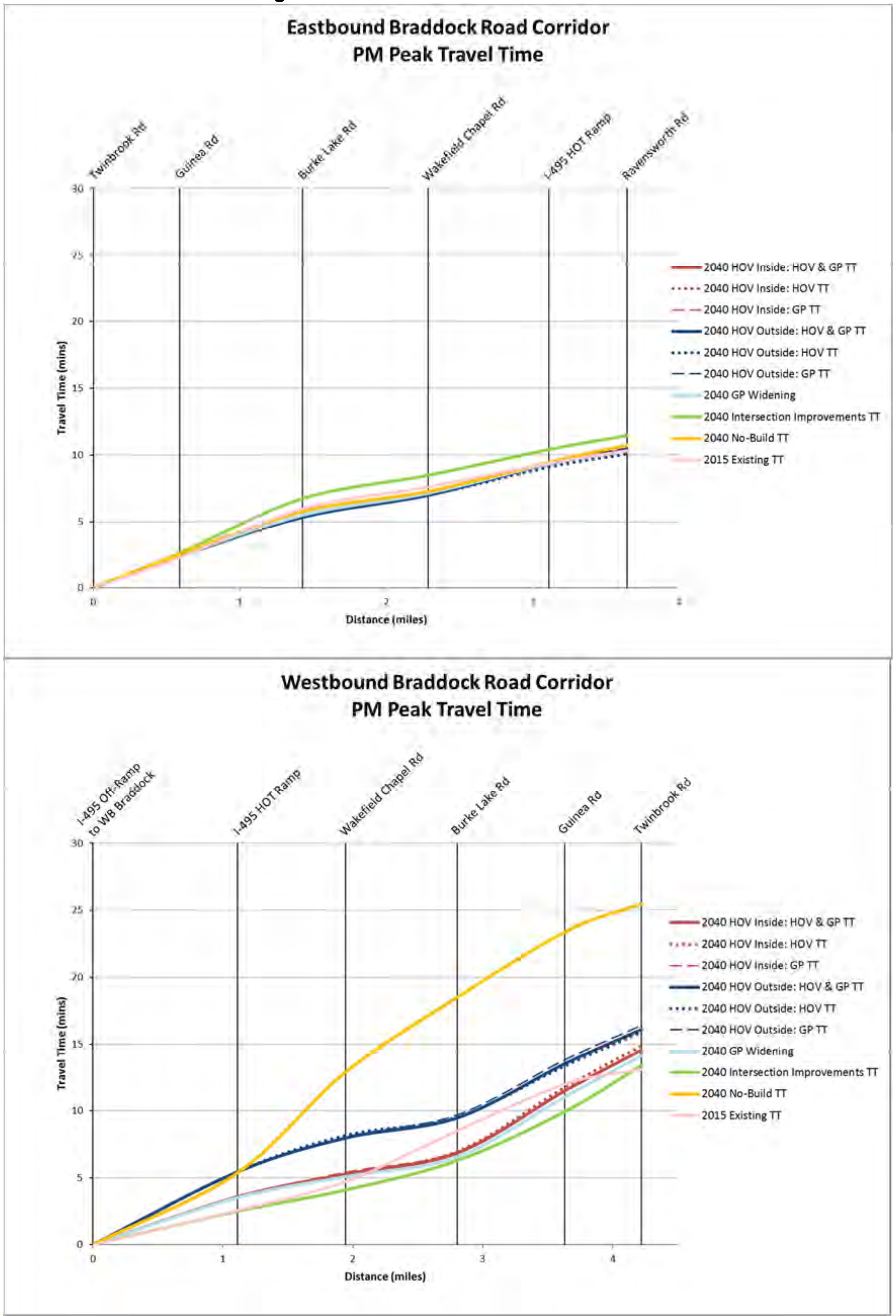
- There were no operational issues noted in the eastbound direction. The travel times were comparable to the Existing Conditions.

Westbound Direction

- The signalized intersections at Guinea Road, Olley Lane and Twinbrook Road were the constraining factors to the westbound flow of traffic for all scenarios.
- In the HOV Inside scenario at the signalized intersection with the HOT Lanes ramp, westbound movements towards Port Royal Road were impacted by two factors.
  - The first factor was the competing need for green time between the eastbound left, westbound through and southbound approach at the intersection with the HOT Lanes ramp. The southbound and westbound approaches were not fully served at this intersection. Furthermore, the westbound approach queue spilled back onto the loop ramp (as in Existing Conditions).
  - Secondly, the entrance of the HOV lane (whether inside or outside) at the downstream signal required traffic to shift to the appropriate lane. This downstream weaving reduced the segment capacity, limiting traffic flows in the westbound direction and creating a queue spillback that further limits throughput.

The PM peak hour travel times for Scenario 1 in both eastbound and westbound directions, with a comparison to No-Build Alternative, are presented in **Figure 5-16**.

Figure 5-16: Scenario 1 PM Travel Time



Scenario 2: Jug-handle with two-lane on-ramp to southbound I-495
To address the eastbound capacity constraint in the AM peak hour, Scenario 1 was modified to assume a geometric change of removing the lane drop on the on-ramp to southbound I-495, so that the ramp would be a two-lane merge with the interstate. As this improvement only benefited the heavy eastbound AM traffic, this scenario was not tested in the PM conditions.

Eastbound Direction

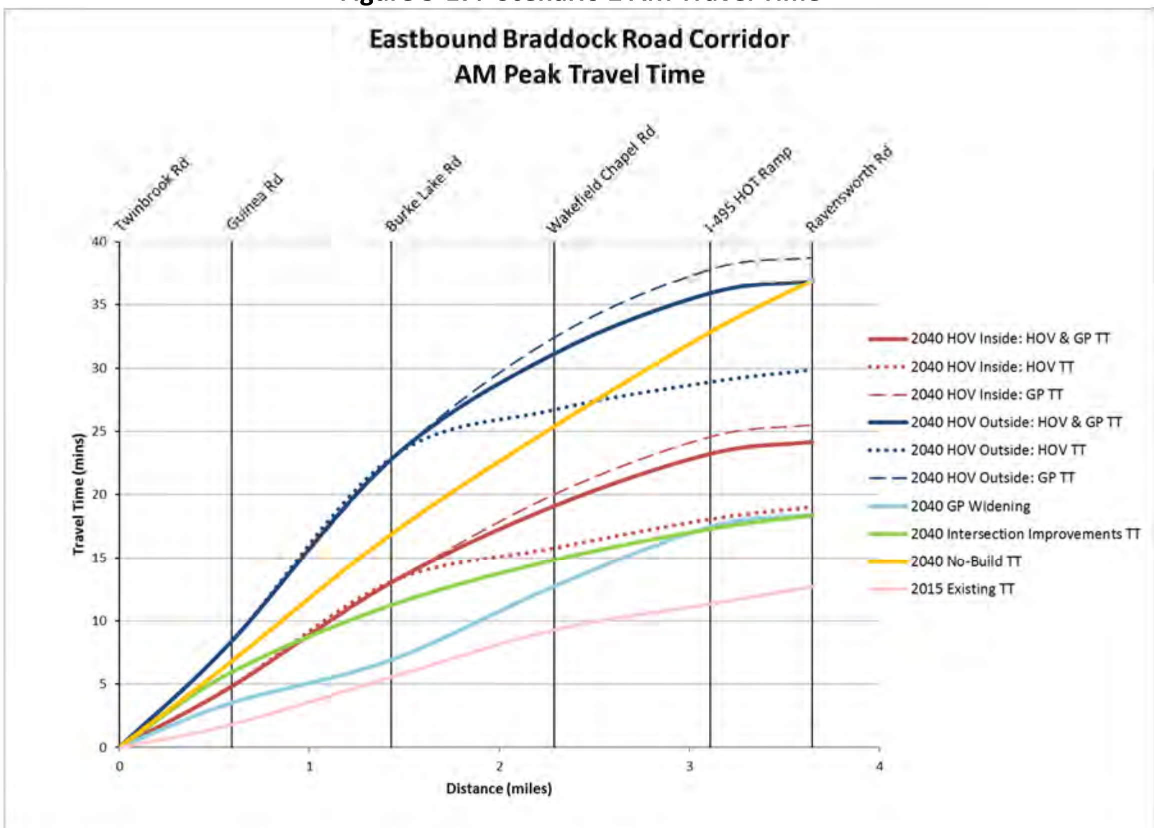
- Intersection and Corridor Improvements – there was no measurable benefit to reducing congestion with modified on-ramp as compared to Scenario 1. The segment of Southampton Drive to Wakefield Chapel Road continued to limit eastbound flow.
- GP Widening – overall throughput increased by 600 vehicles and travel time improved by nearly 4 minutes (from 20.9 to 17.0 minutes for end-to-end trips) as compared to Scenario 1.
- HOV Inside – overall throughput increased by 400 vehicles and travel time improved by nearly 3 minutes (from 22.8 to 20.1 minutes for end-to-end trips) as compared to Scenario 1.
- HOV Outside – as the weaving difficulties at the end of the HOV lane were the constraining factor for eastbound flow, this scenario had no measurable benefit to reducing congestion in the eastbound direction as compared to Scenario 1.

Westbound Direction

- There were no operational issues noted in the westbound direction. Travel times were identical to Scenario 1.

The AM peak hour travel times for Scenario 2 in the eastbound direction, with a comparison to No-Build Alternative, are presented in **Figure 5-17**.

Figure 5-17: Scenario 2 AM Travel Time



Note: Westbound travel time not shown, as Scenarios 1 and 2 travel time were identical.

<u>Scenario 3: Conventional Intersection with one-lane merge onto southbound I-495</u>
This scenario assumed that the Braddock Road intersection at Wakefield Chapel Road/ Danbury Forest Drive was converted to a traditional four-legged intersection. The side street approaches operated as a split phase.

<u>AM Models</u>
Findings for the updated analyses were consistent with the Scenario 1, and are discussed below.

Eastbound Direction

- Intersection and Corridor Improvements – this configuration improved the eastbound throughput at the intersection at Wakefield Chapel Road. However, due to downstream capacity constraints at Queensberry Avenue, the overall net increase of flow was less than 100 vehicles.
- GP Widening – marginal improvement of travel time as compared to Scenario 1; however, the southbound I-495 on-ramps lane drop remained the bottleneck for the corridor.
- HOV Inside – marginal improvement of travel time as compared to Scenario 1; however, the southbound I-495 on-ramps lane drop remained the bottleneck for the corridor.
- HOV Outside – weaving difficulties at the end of the HOV lane created a bottleneck on Braddock Road between Queensberry Avenue and Port Royal Road. HOV eligible vehicles destined the I-495 Express Lanes must cross three lanes to the left to reach the left-turn lane for the I-495 Express Lanes. After the end of

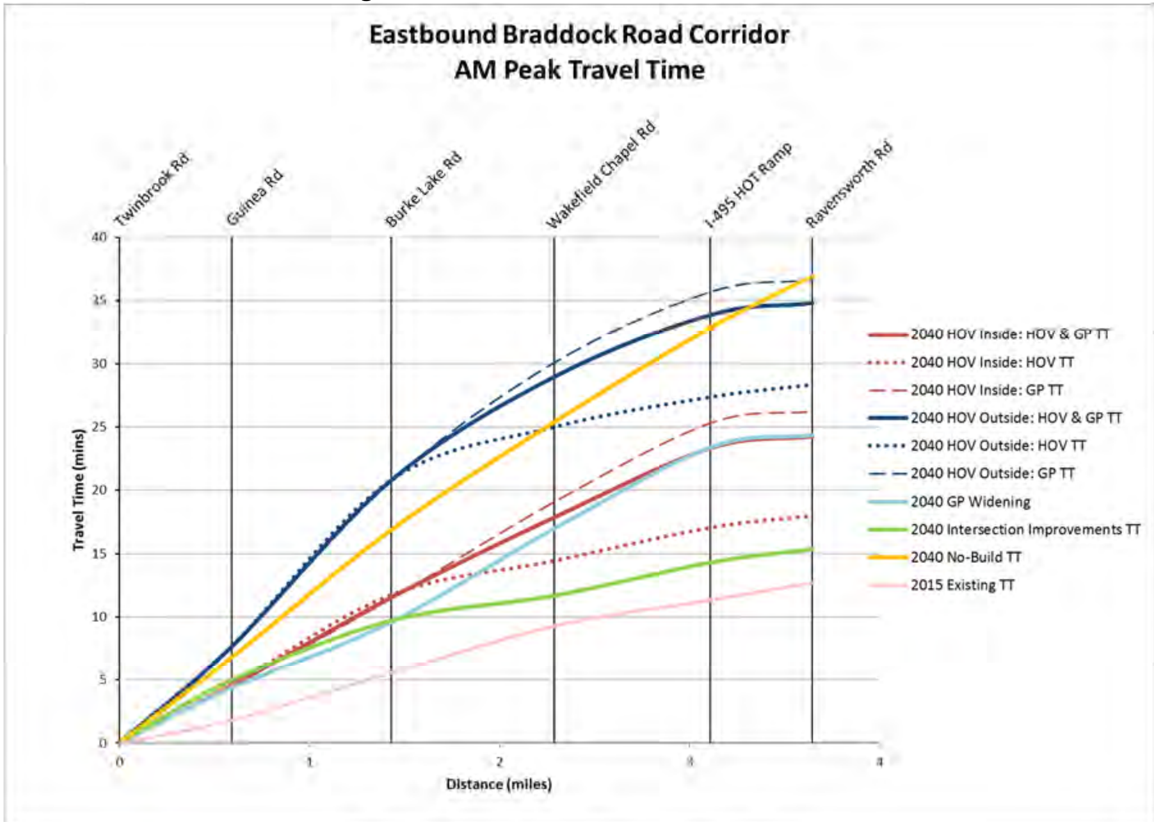
the HOV lane, all vehicles from GP lanes destined to southbound I-495 must weave across one or two lanes to reach the ramp to southbound I-495. This created turbulence in traffic flow.

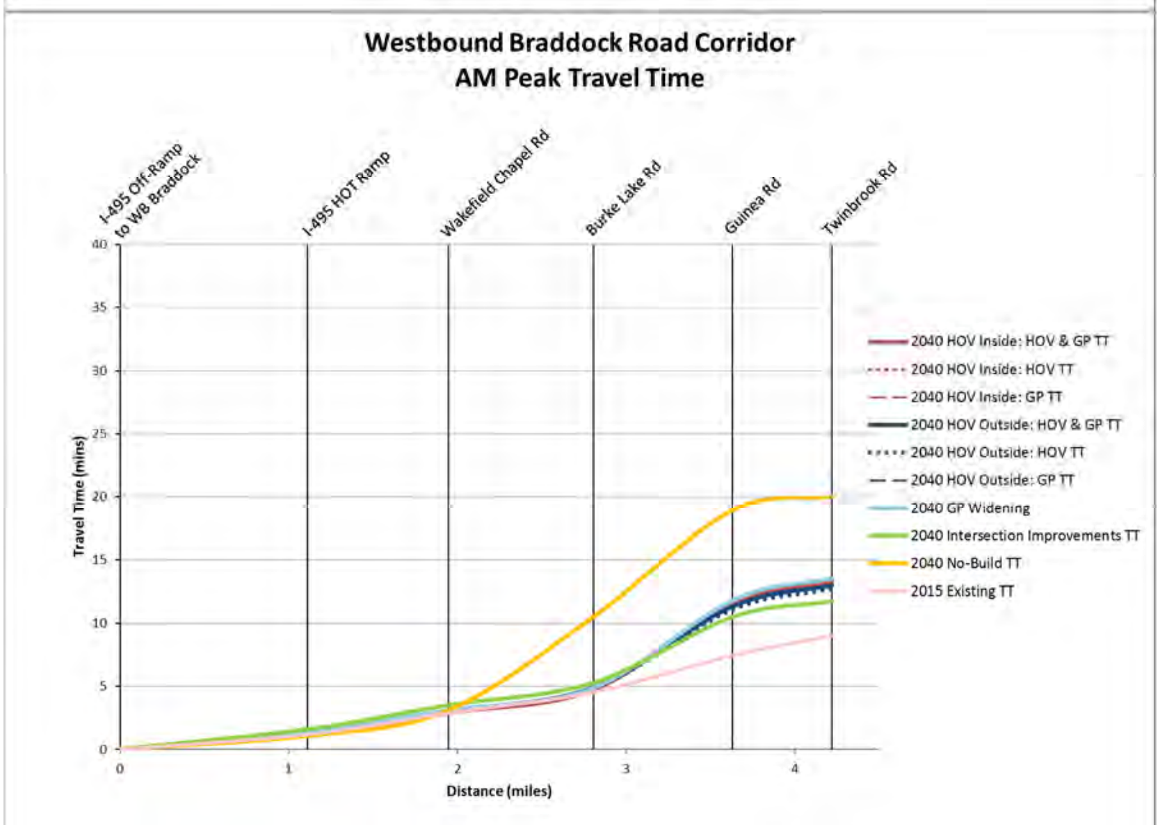
Westbound Direction

- There were no operational issues noted in the westbound direction.

The AM peak hour travel times for Scenario 3 in both eastbound and westbound directions, with a comparison to No-Build Alternative, are presented in **Figure 5-18**.

Figure 5-18: Scenario 3 AM Travel Time





PM Models

Eastbound Direction

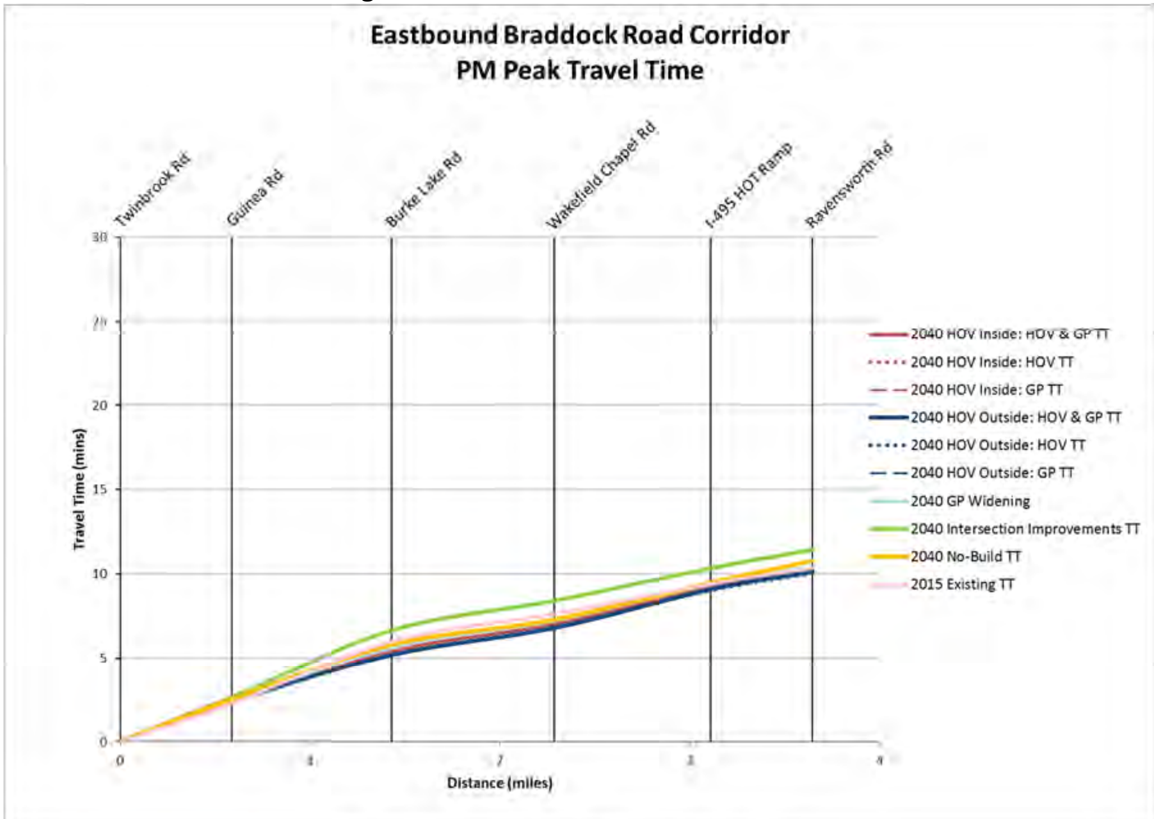
- There were no operational issues noted in the eastbound direction. The travel times were comparable to the Existing Conditions and identical to Scenario 1.

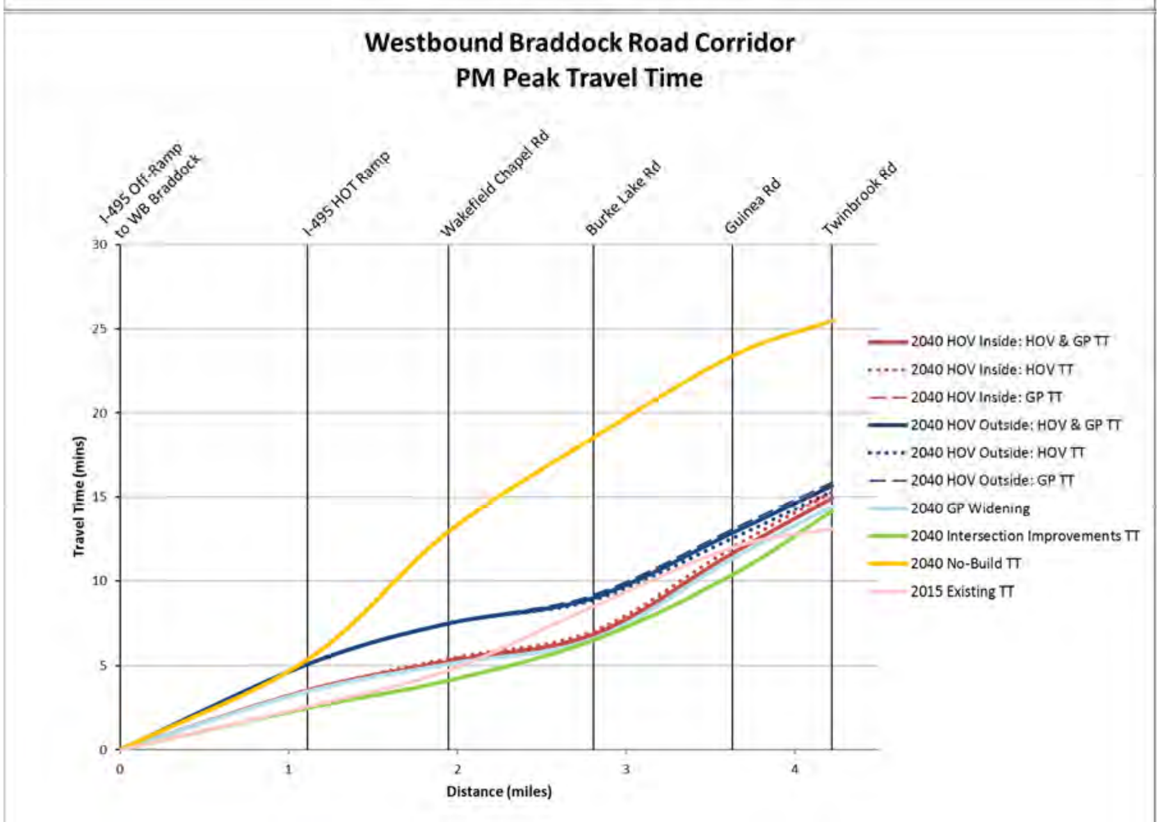
Westbound Direction

- The findings for the westbound direction were consistent with Scenario 1.
    - The signalized intersections at Guinea Road, Olley Lane and Twinbrook Road were the constraining factors to the westbound flow of traffic for all scenarios.
    - In the HOV Inside scenario at the signalized intersection with the HOT Lanes ramp, westbound movements towards Port Royal Road were impacted by two factors.
        - The first factor was the competing need for green time between the eastbound left, westbound through and southbound approach at the intersection with the HOT Lanes ramp. The southbound and westbound approaches were not fully served at this intersection. Furthermore, the westbound approach queue spilled back onto the loop ramp (as in Existing Conditions).
        - Secondly, the entrance of the HOV lane (whether inside or outside) at the downstream signal required traffic to shift to the appropriate lane. This downstream weaving reduced the segment capacity, limiting traffic flows in the westbound direction and creating a queue spillback that further limits throughput.

The PM peak hour travel times for Scenario 3 in both eastbound and westbound directions, with a comparison to No-Build Alternative, are presented in **Figure 5-19**.

Figure 5-19: Scenario 3 PM Travel Time





Scenario 4: Conventional Intersection with 2-lane on-ramp to southbound I-495

To address the eastbound capacity constraint in the AM peak hour, the above Conventional scenario was modified to assume a geometric change of removing the lane drop on the on-ramp to southbound I-495, so that the ramp would be a two-lane merge with the interstate. As this improvement only benefits the heavy eastbound AM traffic, this scenario was not tested in the PM conditions.

Eastbound Direction

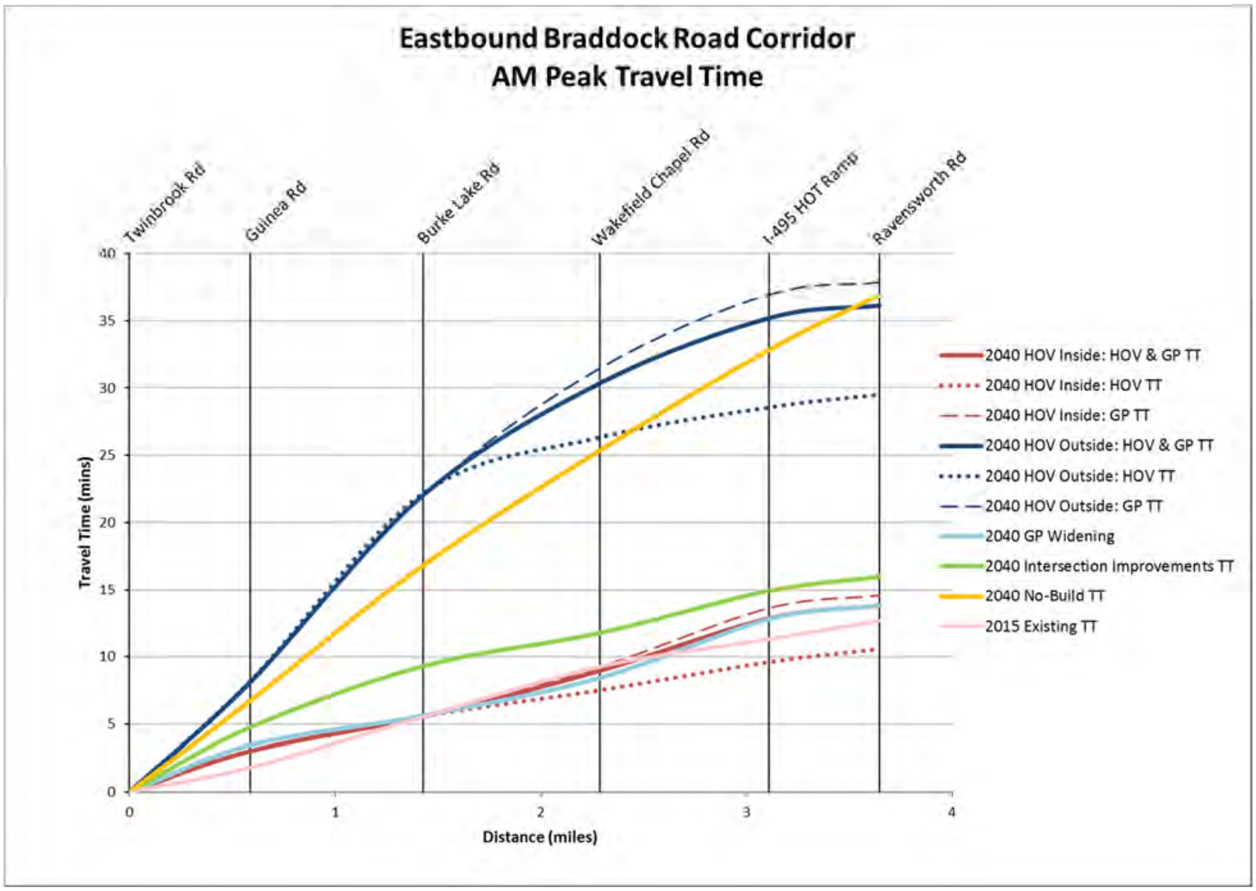
- Intersection and Corridor Improvements – eliminating the lane drop on the on-ramp had no measurable benefit to reducing congestion in the eastbound direction. The segment of Southampton Drive to Wakefield Chapel Road continued to limit eastbound flow.
- GP Widening – overall throughput increased by 750 vehicles and travel time improved by over 5 minutes (from 18.9 to 13.4 minutes) as compared to Scenario 3 (the base Conventional Intersection scenario without the two-lane on-ramp).
- HOV Inside – overall throughput increased by 600 vehicles and travel time improved by over 5 minutes (from 18.4 to 13.1 minutes) as compared to Scenario 3.
- HOV Outside – As the weaving difficulties at the end of the HOV lane were the constraining factor for eastbound flow, eliminating the lane drop on the on-ramp had no measurable benefit to reducing congestion in the eastbound direction.

Westbound Direction

- There were no operational issues noted in the westbound direction.

The AM peak hour travel times for Scenario 4 in the eastbound direction, with a comparison to No-Build Alternative, are presented in **Figure 5-20**.

Figure 5-20: Scenario 4 AM Travel Time



Note: Westbound travel time not shown, as Scenarios 1 and 2 travel time were identical.

<u>Summary</u>

AM Peak Hour

- There was no significant difference between the Jughandle and Conventional Intersection configurations (Scenarios 1 and 3) for all Alternatives with no improvements to southbound I-495 on-ramp.
- In comparing the scenarios with the two-lane on-ramps, Scenarios 2 and 4, the Conventional Intersection configuration had the better travel time and higher throughput.
  - o The two-lane improvement to the southbound I-495 on-ramp benefited the GP Widening and HOV Inside as the constraint was removed for the corridor.
  - o The two-lane improvement to the southbound I-495 on-ramp had little bearing for capacity improvements for the:
    - ▪ HOV Outside Alternative as the weaving at the end of the outside HOV lane hindered any potential for throughput increase.
    - ▪ Intersection and Corridor Improvements Alternative as the capacity constraint at Queensberry Avenue limited potential for throughput increase.

PM Peak Hour

- There was no noticeable difference in operations between the Jughandle and Conventional Intersection configurations (Scenarios 1 and 3) in the PM peak hour for all Alternatives (Intersection and Corridor Improvements, GP Widening, HOV Inside, and HOV Outside).

Refer to Appendix K for detailed MOEs for the four Build scenarios tested.

Final Configuration

The Study Team reviewed the findings from the Scenario Screening and adopted the following improvements:

- Conventional Intersection at Wakefield Chapel Road / Danbury Forest Drive.
- Two-lane merge onto southbound I-495.

The final VISSIM models were updated to reflect the above selection of improvements from the Scenarios Screening. These improvements were integrated into all four Alternatives to develop the final Alternatives. This section discusses the findings of the Final Configuration and considers the following metrics for evaluation:

- Intersection LOS,
- Mainline Travel Time,
- Network Performance,
- Network Transit Travel Time,
- Demand versus Throughput, and
- Residential Side Street Delay.

Intersection LOS

The LOS rating represents the delay experienced by SOV, HOV, HGV and buses at the study intersections. **Table 5-3** presents the LOS summary by Alternative for the AM and PM peak hours.

Alternative	Equivalent LOS					
	A	B	C	D	E	F
AM Peak Hour						
Existing Conditions	0	0	5	3	5	0
No-Build Alternative	0	0	0	0	1	12
Intersection Imp. Alternative	0	0	2	3	3	5
HOV Outside Alternative	0	0	2	0	0	11
HOV Inside Alternative	0	0	2	2	2	7
GP Widening Alternative	0	0	2	1	3	7
PM Peak Hour						
Existing Conditions	0	2	3	5	2	1
No-Build Alternative	0	1	0	4	4	4
Intersection Imp. Alternative	0	0	5	2	4	2
HOV Outside Alternative	0	1	3	4	2	3
HOV Inside Alternative	0	2	3	3	0	5
GP Widening Alternative	0	2	3	4	0	4

Table 5-3: Intersection LOS Summary

AM Peak Hour

- The No-Build Alternative had twelve intersections at LOS F and one at LOS E – all (thirteen) study intersections at an undesirable LOS. The Build Alternatives had varying degrees of improvement:
  - The Intersection and Corridor Improvements Alternative had five intersections at LOS F and three at LOS E - eight in total.
  - The HOV Inside Alternative had seven intersections at LOS F and two at LOS E - nine in total.
  - The GP Widening Alternative had seven intersections at LOS F and three at LOS E - ten in total.
  - The HOV Outside Alternative had eleven intersections at LOS F and this was only a marginal improvement over No-Build. As previously discussed in the Scenarios Screening, the weaving conditions at the end of the eastbound HOV lane between HOV and GP vehicles was a major bottleneck for the corridor.

PM Peak Hour

- The No-Build Alternative had four intersections at LOS F and four at LOS E (eight total at an undesirable LOS). The Build Alternatives all had similar improvement in LOS:
  - The Intersection and Corridor Improvements Alternative had four intersections at LOS F and two at LOS E (six total).
  - The HOV Inside Alternative had five intersections at LOS F (five total).
  - The GP Widening Alternative had four intersections at LOS F (four total).
  - The HOV Outside Alternative had three intersections at LOS F and two at LOS E (five total).

The Intersection and Corridor Improvements Alternative had the greatest improvement for intersection LOS in the AM peak hour, while the GP Widening Alternative had the greatest improvement in the PM peak hour. Considering both peak hours together, the Intersection and Corridor Improvements, HOV Inside and GP Widening Alternatives had the same level of improvement. Refer to Appendix L for the full MOE tables for the Final Configuration results for the No-Build and Build Alternatives.

Mainline Travel Times

This section discusses the AM and PM peak hour travel times and describes critical locations that affect overall flow.

<u>AM Peak Hour</u>

Eastbound Direction

- Overall, there was a slight difference among the Intersection and Corridor Improvements, HOV Inside and GP Widening Alternatives in terms of eastbound travel time (15.2 to 16.4 minutes). The HOV Inside Alternative edged the other two Alternatives for eastbound travel time. These Alternatives reduced the overall eastbound travel time by more than half compared to the No-Build Alternative (from 37.4 minutes to 15.2 for HOV Inside). No operational issues were noted for HOV traffic exiting the HOV lane to weave across the GP lanes to access the ramp to southbound I-495.
- The HOV Outside continued to perform poorly. This was due to the weaving difficulties at the end of the HOV lane being the constraining factor for eastbound flow. HOV vehicles would weave from the HOV lane across the GP lanes to access the 495 Express Lanes to travel northbound. The weave movement would impact GP vehicles destined to southbound I-495, as throughput and speeds are reduced. Overall, this Alternative only reduced the eastbound AM peak hour travel time approximately three minutes compared to the No-Build Alternative.
- The two-lane on-ramp to southbound I-495 reduced the congestion on Braddock Road.

Westbound Direction

- The four Build Alternatives performed similarly to each other in the westbound direction, as travel time ranged from 11.8 minutes (Intersection and Corridor Improvements) to 13.8 minutes (GP widening). This represents a 50 percent improvement compared to the No-Build Alternative. The largest factor for improved travel time in the off-peak direction was the addition of the westbound right turn bay at Guinea Road.

<u>PM Peak Hour</u>

Eastbound Direction

- The four Build Alternatives performed similarly to each other in the eastbound direction, as travel time ranged from 10.3 (HOV Outside) to 11.5 minutes (Intersection and Corridor Improvements). These were in-line with the No-Build Alternative, the slight increase of travel time over No-Build was attributed to the modification of signal progression to benefit the peak flow westbound direction.

Westbound Direction

- Overall, there was a minor difference among the Intersection and Corridor Improvements, HOV Inside and GP Widening Alternatives in terms of westbound travel time (14.4 to 14.9 minutes), with the Intersection and Corridor Improvements edging the other two Alternatives for westbound travel time. It is a 42 percent reduction of the westbound travel time compared to the No-Build Alternative (from 24.9 minutes to 14.4 for Intersection and Corridor Improvements).

- The HOV Outside Alternative performed slightly worse at 16.2 minutes for the westbound travel time. This was due to the entrance of the HOV lane beyond Port Royal Road which required traffic to shift to the appropriate lane. This downstream weaving reduced the segment capacity, limiting traffic flows in the westbound direction.

Figure 5-21 and **Figure 5-22** present the AM and PM peak hour travel times for the No-Build and Build Alternatives.

Figure 5-21: Final Alternatives AM Travel Time

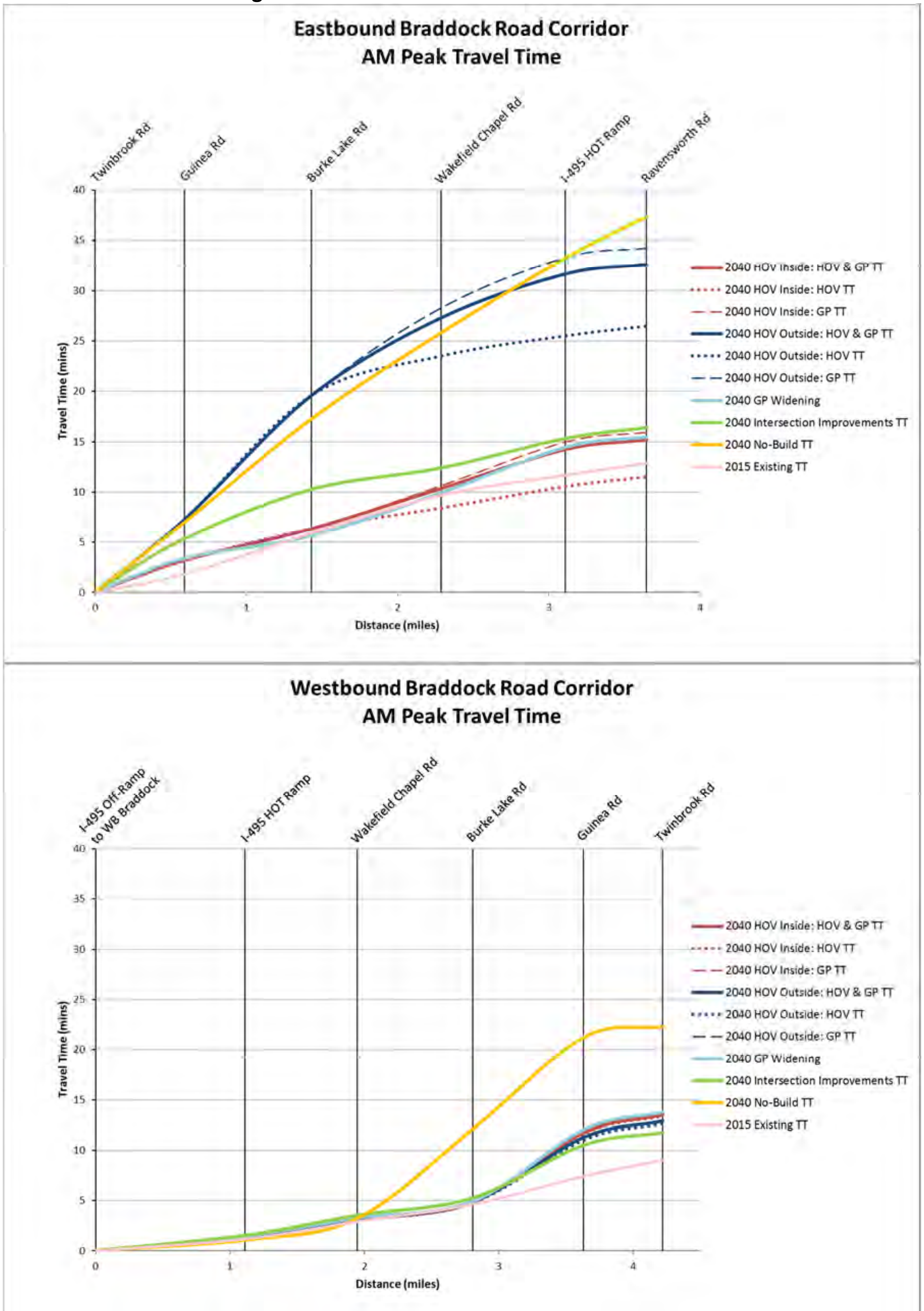
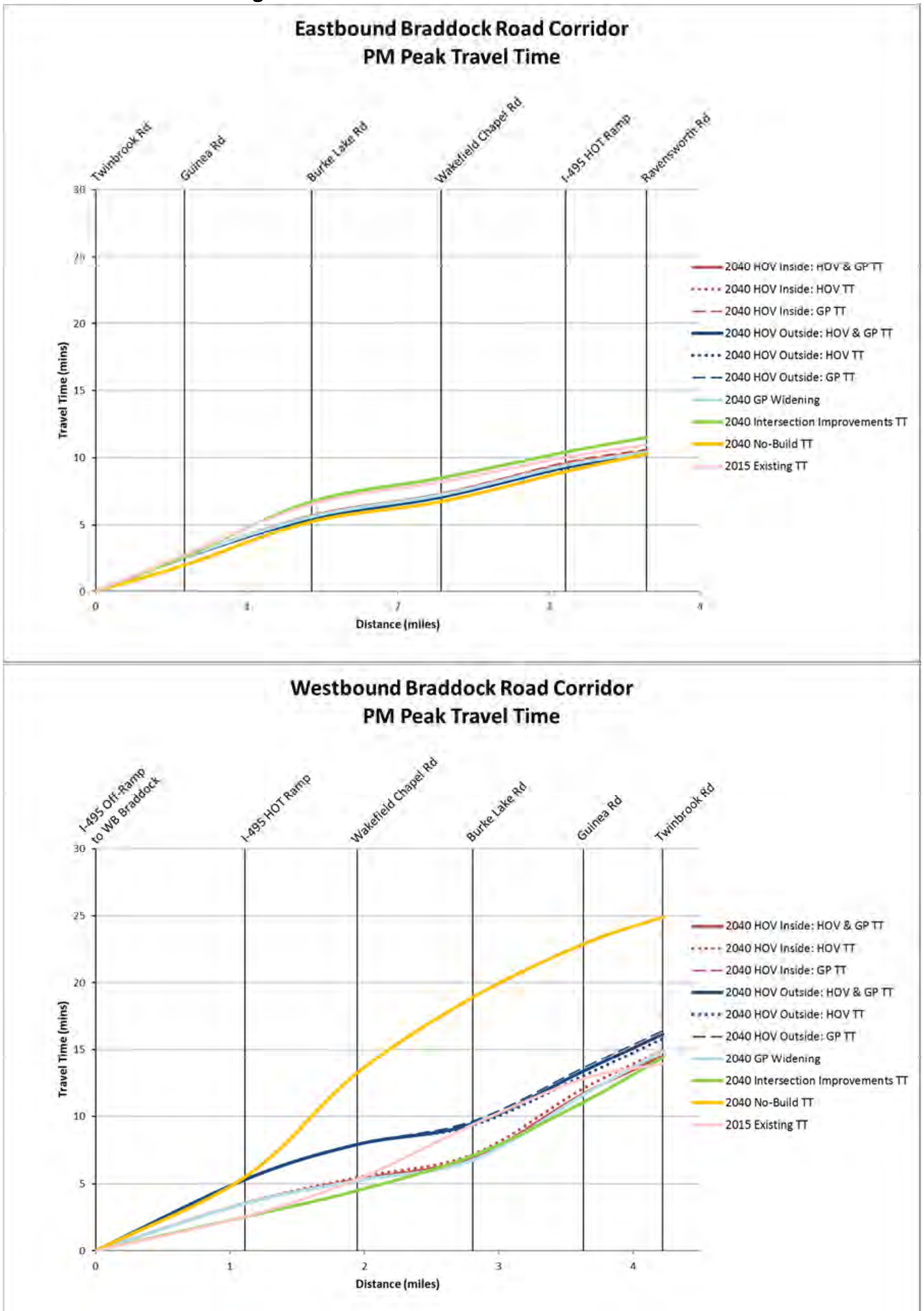


Figure 5-22: Final Alternatives PM Travel Time



Refer to Appendix L for the travel time details for the Final Configuration results for the No-Build and Build Alternatives.

Network-Wide Travel Time

Table 5-4 presents the VISSIM Network-wide Performance MOEs. The two MOEs that were used include average travel time and total (network) travel time. These two MOEs are interdependent, as the average travel time was computed based on the network total travel time and number of vehicles in the network.

The average (vehicular) travel time for the Intersection and Corridor Improvements, GP Widening and HOV Inside Alternatives were very similar for the AM peak hour. The HOV Outside Alternative had a higher travel time compared to the other three Build Alternatives due to the weave condition at the end of the eastbound HOV lane. In the PM peak hour, the Intersection and Corridor Improvements had the lowest average travel time for 2040 conditions, closely followed by the other three Build Alternatives.

Scenario	Average Travel Time (sec/veh)	Total Travel Time (hr)	% Change to 2015 Existing Avg. Travel Time	% Change to 2040 No Build Avg. Travel Time
AM				
2015 Existing	347.6	1,444	-	-
2040 No Build	745.4	3,096	114%	-
2040 Intersection Improvements	490.2	2,224	41%	-34%
2040 HOV Outside	610.5	2,834	76%	-18%
2040 HOV Inside	497.6	2,429	43%	-33%
2040 GP Widening	505.9	2,459	46%	-32%
PM				
2015 Existing	370.2	1,533	-	-
2040 No Build	517.4	2,272	40%	-
2040 Intersection Improvements	394.5	1,778	7%	-24%
2040 HOV Outside	427.7	1,977	16%	-17%
2040 HOV Inside	428.6	2,010	16%	-17%
2040 GP Widening	423.3	1,982	14%	-18%

Table 5-4: VISSIM Network Performance MOEs

Network Transit Travel Time

The average network transit time considered buses along Braddock Road mainline and is shown in **Table 5-5**. The travel time was computed as the two-way average (eastbound and westbound).

Scenario	Average Transit Travel Time (min)	
	AM	PM
2015 Existing	10.9	12.4
2040 No Build	29.8	17.6
2040 Intersection Improvements	14.1	12.9
2040 HOV Outside	19.6	13.0
2040 HOV Inside	14.8	12.6
2040 GP Widening	14.6	12.6

Table 5-5: Average Network Travel Time

Overall, the Intersection and Corridor Improvements, GP Widening and HOV Inside Alternatives performed similarly in the AM peak hour. In the PM peak hour, all four Build Alternatives performed similarly. The Build Alternatives improved transit travel time as compared to the No-Build Alternative for both peak hours.

Network Demand Versus Throughput

Figure 5-23 and **Figure 5-24** present the AM and PM peak hour person demand and throughput. The person demand and throughput captured SOV, HOV and transit trips at cordon points in the study area. The findings are as follows:

AM Peak Hour

- The GP Widening Alternative had the highest person throughput followed by the HOV Inside Alternative.
- The HOV Outside Alternative had the lowest throughput for the Build Alternatives due to the bottleneck at the end of the eastbound HOV lane. This bottleneck was caused by the weaving traffic between HOV and GP lanes.
- The No-Build had a lower throughput as compared to the Existing Conditions. Multiple bottlenecks contributed to this deterioration of throughput.

PM Peak Hour

- The HOV Inside Alternative had the highest throughput, closely followed by the GP Widening and HOV Outside Alternatives.
- Although the Intersection and Corridor Improvements Alternative had a lower throughput as compared to the other Build Alternatives, it should be noted that its peak hour demand was lower.
- The No-Build Alternative moved marginally more people than the Existing Conditions due to the existing bottlenecks along the corridor.

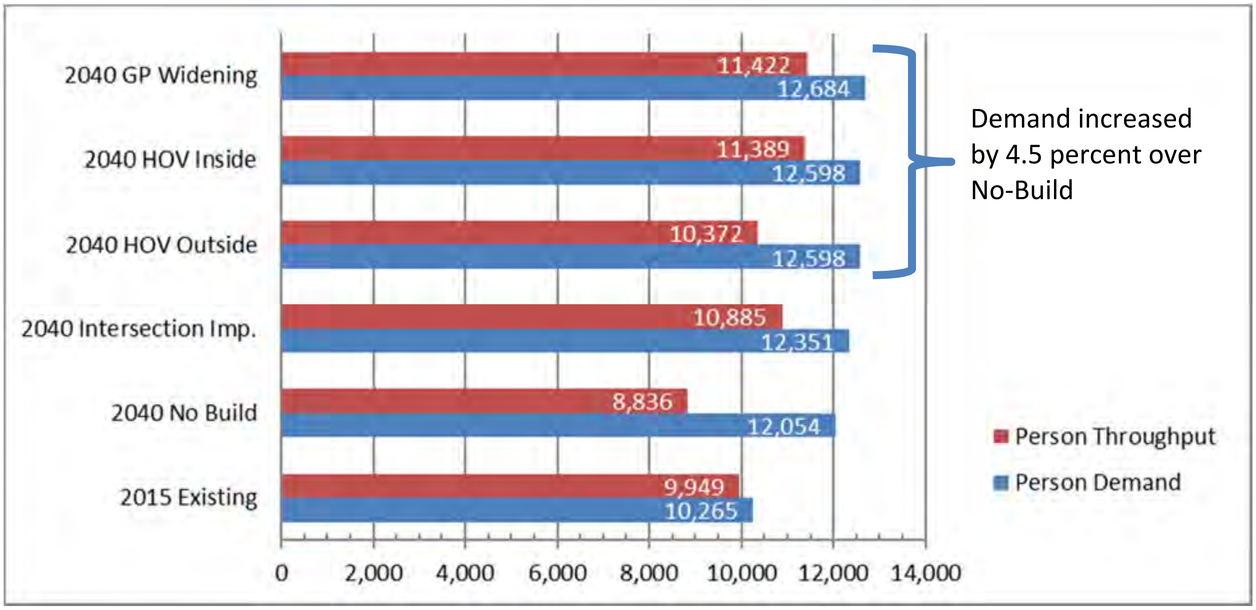


Figure 5-23: AM Peak Hour Person Throughput

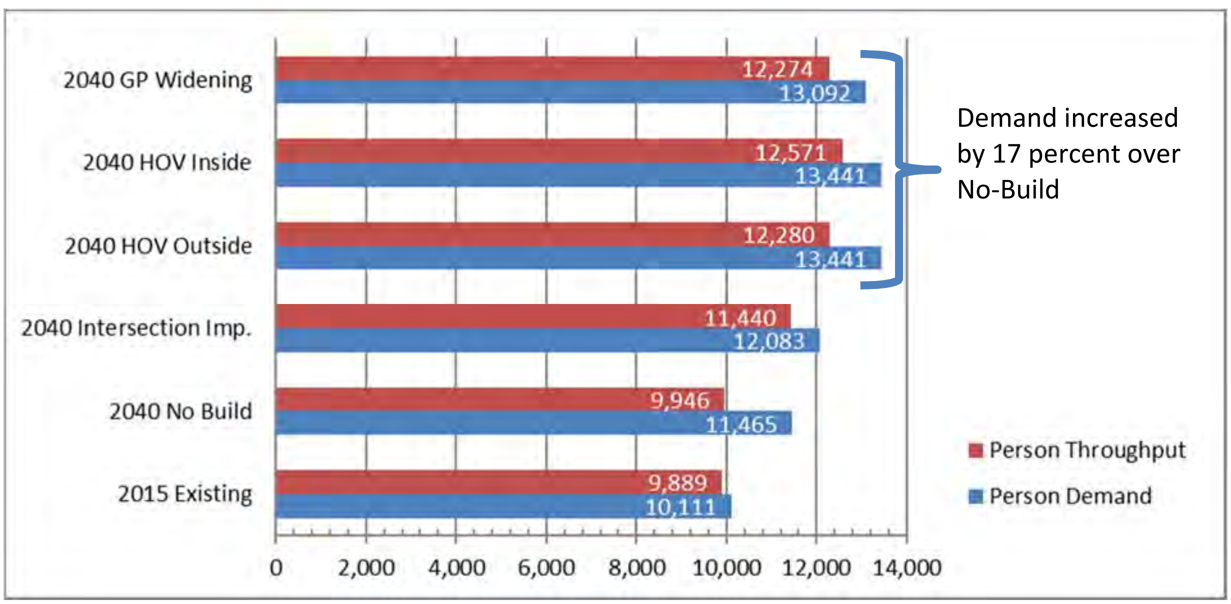


Figure 5-24: PM Peak Hour Person Throughput

Residential Side Street Delay

Table 5-6 presents the residential side streets travel time and delay. For the AM peak hour, the HOV Outside and GP Widening Alternatives had the greatest improvement over the No-Build Alternative. However, it should be noted that the HOV Outside Alternative had the highest travel time of the Build Alternatives. The side street delay was lower for this Alternative as the minor street traffic could turn into the HOV lane (on the outside) and then merge into the GP lanes. In the HOV Inside Alternative, it was more difficult for residential side street traffic to enter onto Braddock Road as the GP traffic was on the outside.

In the PM peak hour, the four Build Alternatives reduced delay for the residential side streets between 50 and 59 percent.

Scenario	Average Delay (sec/veh)	Total Delay (hr)	*Compared to 2015 Existing* **Total Delay - % Change**	*Compared to 2040 No Build* **Total Delay - % Change**
AM				
2015 Existing	57.2	21.2	-	-
2040 No Build	144.2	53.7	153%	-
2040 Intersection Improvements	95.8	42.4	100%	-21%
2040 HOV Outside	60.2	25.4	20%	-53%
2040 HOV Inside	147.4	62.2	194%	16%
2040 GP Widening	62.7	27.1	28%	-50%
PM				
2015 Existing	72.6	21.2	-	-
2040 No Build	195.5	66.4	213%	-
2040 Intersection Improvements	76.1	32.9	55%	-50%
2040 HOV Outside	68.9	27.0	27%	-59%
2040 HOV Inside	72.5	28.4	34%	-57%
2040 GP Widening	77.2	32.3	52%	-51%

Table 5-6: Residential Side Street Travel Time/ Delay

Traffic Operational Conclusions

The findings of the 2040 VISSIM traffic of the No-Build Alternative and the four Build Alternatives are provided by the metrics below:

- Intersection LOS:
    - Considering both peak hours, the Intersection and Corridor Improvements, HOV Inside and GP Widening Alternatives all had similar improvement to LOS.
    - The HOV Outside Alternative had the lowest improvement to LOS conditions, due to the poor performance of the eastbound HOV lane in the AM peak hour. This was due to the weaving of HOV and GP vehicles across multiple lanes to access I-495 created turbulence in the traffic flow.
- Mainline Travel Time:
    - Travel time had deteriorated without improvements to the corridor, and travel time had more than double compared to the Existing Conditions if no improvements were made.
    - The Build Alternatives did not eliminate congestion along the corridor, as traffic was projected to increase.
    - Braddock Road mainline travel times for three Build Alternatives (Intersection and Corridor Improvements, HOV Inside and GP Widening Alternatives) were comparable to the Existing Conditions.

- Network-wide Travel Time
  - The Intersection and Corridor Improvements, GP Widening and HOV Inside Alternatives had similar improvement over the No-Build Alternative for the AM peak hour. The Intersection and Corridor Improvements had the largest improvement in the PM peak hour.
- Transit Travel Time
  - The Build Alternatives improved transit travel time as compared to the No-Build Alternative for both peak hours. The HOV Outside Alternative performed poorly in the AM peak hour due to the weave conditions at the end of the eastbound HOV lane.
- Network-wide Demand versus Throughput
  - The HOV Inside and GP Widening Alternatives provided the greatest person-throughput improvement for the corridor by all modes.
- Residential Side Street Delay
  - In the AM peak hour, the side street delay was lower for the HOV Outside Alternative. The minor street traffic could turn into the HOV lane (on the outside) and then merge into the GP lanes.
  - In the PM peak hour, all four Build Alternatives performed similarly.

As part of the visual review of the VISSIM model it was determined that for all the build alternatives various intersections outside of the direct Braddock Road corridor required modification:

- The lane drop along Northbound Guinea Road was creating a queue which during the PM peak hour in particular was blocking the intersection with Braddock Road. As part of sensitivity testing, it was determined that this could be alleviated by extending the two-lane section further north to Burnette Drive. The additional thru lane terminates as a right-turn only lane at Burnette Drive to create a safer driving environment.
- A left-turn lane was included along Ravensworth Road at Heritage Drive to prevent backups along Ravensworth Road.
- Additional thru lane along Northbound Wakefield Chapel Road from Braddock Road to Stahlway Lane. The additional thru lane terminates as a right-turn only lane at Stahlway Lane.
- A signal was included at the intersection of Rolling Road and Parliament Drive. See Appendix R.

It was determined by the Project Team that based on a review of the data from the travel demand model and the traffic simulation analysis results, that HOV 3 would only be considered in a situation where their appeared to be a sufficiently high percentage of HOV vehicles with 3 or more rides as shown from the travel demand model, and where the HOV 2+ condition was not performing operationally. It was determined that neither of these conditions were met, and therefore HOV 3 was not considered further.

Due to operational concerns and the above HOV 3 considerations, a HOT (High-Occupancy Toll) lane alternative was dropped from consideration before the study's conclusion. The operational concerns included: how the lanes would be tolled, enforcement, and access in/out of the lanes.

In summary, three of the 2040 Build Alternatives (Intersection and Corridor Improvements, HOV Inside and GP Widening Alternatives) provided comparable improvements over the No-Build Alternative when all six metrics were considered. Of these three, the HOV Inside and GP Widening Alternatives provided higher person throughput in both peak hours as compared to the Intersection and Corridor Improvements Alternative. The transit center at Kings Park Shopping Center had no bearing on the travel time along Braddock Road.

H. Cost Estimates

One aspect of the selection process included comparing the estimated cost for each of the improvement alternatives. A conceptual level cost estimate was developed for each of the improvements alternatives that includes construction and right-of-way costs.

- Intersection and Corridor Improvements $35.0 Million
- Widening Alternative: HOV Inside Lanes $101.7 Million
- Widening Alternative: General Purpose Lanes $101.7 Million

The widening alternatives are much higher in cost compared to the Intersection and Corridor Improvements alternative because of the greater amount of construction required, right-of-way required, and requires an on-ramp lane extension of the two-lane ramp from Eastbound Braddock Road to I-495 Southbound. See Appendix E for the detailed conceptual level cost estimates.

Chapter 6: Roadway Measurements of Effectiveness (MOE)

In order to achieve the stated goals of The Braddock Road Multimodal Study, the various improvement alternatives were evaluated, and ultimately a single preferred alternative was chosen. The process included developing Measurements of Effectiveness (MOE) and calculating scores for the MOEs from both the technical study team and the Task Force.

A. Development of MOEs

The MOEs for the improvement alternatives were developed in coordination with the County staff and the Task Force. **Table 6-1** presents the final MOEs and the performance measures for each of the MOEs.

What you care about/ MOE		Description of MOE	Performance Measures - Metrics
Environment	1	Availability for screening or landscaping enhancements	Area available for tree planting minus area of tree removal (square feet). A negative number means that there is a net loss of plantable area.
	2	Will alternative provide additional opportunities for bike/ pedestrian travel?	Linear feet of additional paths and number of crosswalks, crosswalk signals or pedestrian overpasses (length in feet). Considering this project is intended to provide additional access by all travel modes, a positive number means more bike/pedestrian path opportunities are available
	3	Park Land Impacts	Amount of land taken from parks for road (acres). This is a measure of the area of land taken from parks for the road improvements. The evaluation should consider the area taken related to the overall park area and the potential loss of amenities due to the loss of area.
	4	Does the alternative improve or degrade the noise levels experienced by those adjacent to the corridor?	Noise levels as measured by traffic models (decibels average - based on average AM / PM TNM Lookup values.) Evaluation should consider where a change becomes noticeable, where it becomes painful and where it becomes damaging.
	5	Does the alternative improve or degrade the air quality experienced by those adjacent to the corridor?	Air quality levels as measured by traffic models (Pounds of GHG emissions average - sum of AM / PM peak based on WSDOT corridor planning values.). Evaluation should consider where a change becomes noticeable, where it becomes unhealthy.
Mobility	6	Does the alternative facilitate community access to Braddock Road?	Travel time for vehicles in the system to and from the neighborhoods (seconds per vehicle averaged over all trips.) This is an indication of how long it will take to get into and out of the neighborhoods adjacent to the study corridor.
	7	Pedestrian/Bicycle travel time	Pedestrian/bicycle Travel time (minutes - for the entire network and critical movements for EB and WB traffic along Braddock Road). Lowering the pedestrian/bicycle travel time improves the desirability of the corridor for pedestrian and bicycle trips.
	8	Will the alternative provide better access and circulation for pedestrians and bicycles, as represented by the number of broken path links restored?	Net change in the number of broken path links restored by the option (number). -This is a measure of how the option provides connectivity of paths to and between the neighborhoods along the study corridor.
Safety	9	Is it likely that existing conflict areas are improved?	Number of corridor-wide conflict points (number). This is a count of the number of conflict points along the corridor. A reduction in the number of conflict points is considered to improve safety.
	10	Is it likely that the suggested improvements will lower or increase potential crashes?	Highway Safety Manual Computed Expected Crash Rate (crashes/year - current value 150.) This is a computation of the anticipated number of crashes along the corridor, based on the proposed characteristics of the corridor. An improvement is the reduction in the number of crashes computed.
	11	Are safe movements provided for pedestrians and bicycles?	Number of signal-protected crossings and number of grade separated crossings. A higher number is considered better for pedestrian and bicycle access.
Transportation Network Efficiency	12	Option that creates the least aggregate travel time	Vehicular travel time (minutes per vehicle). Lowering the travel time improves network traffic flow as well as travel time within the community.
	13	Travel time represented by critical movements	Average Travel time (minutes - Average of EB / WB travel time and average of AM / PM peak values.) Lowering the travel time improves person throughput through the corridor.
	14	Does the alternative facilitate traffic through the corridor?	Person throughput (number of person trips processed through the corridor - sum of AM and PM peaks.) This is a measure of how well the option processes person trips through the network.
ROW Impacts	15	Total area of right-of-way taken (fee R/W - acres)	Area of right-of-way taken (acres). Total area of right-of-way taken is land permanently taken from the adjacent property for the corridor improvements. The area taken does not necessarily mean that the use of the properties impacted is reduced in any way.
	16	Number of parcels impacted (including temporary and permanent easements)	Number of impacted parcels (each). This is the total number of parcels where some sort of right-of-way or easements will be required, based on the conceptual plans developed.

Table 6-1: MOEs and Performance Measures

After completing the development of the MOEs the Task Force developed a scoring weight for each of the major MOE categories (categories located in the far left column of **Table 6-1** above). The weight for each category: Environment: 4.5, Mobility: 4.7, Safety: 4.7, Transportation Network Efficiency: 2.6, and ROW Impacts: 3. Performance measure scoring under each MOE category are averaged and then multiplied by these weights, see **Table 6-2** (Blank Scores, see next page).

B. Evaluations

The Technical Team included both County staff and RK&K staff. **Table 6-3** below is a summary of the scores from the Technical Team and Task Force. **Table 6-4** presents the MOE scoring from the Technical Team**. Table 6-5** presents the MOE scoring from the Task Force.

Alternatives	Technical Team	Task Force
Intersection and corridor Improvements	**12.30**	**8.41**
Widening Alternative: General Purpose (Use) Lanes	12.17	4.84
Widening Alternative: HOV Inside Lanes	10.60	0.81

Table 6-3: Scoring Summary

What you care about/ MOE		Description of MOE	Performance Measures - Metrics	Task Force Weights	No-Build		Intersection Improvements		HOV2 Inside		General Use Lane Addition	
					Measure	Score	Measure	Score	Measure	Score	Measure	Score
Environment	1	Availability for screening or landscaping enhancements	Area available for tree planting minus area of tree removal (square feet). A negative number means that there is a net loss of plantable area.	4.5	0		-756,200		-968,800		-1,011,700	
	2	Will alternative provide additional opportunities for bike/ pedestrian travel?	Linear feet of additional paths and number of crosswalks, crosswalk signals or pedestrian overpasses (length in feet). Considering this project is intended to provide additional access by all travel modes, a positive number means more bike/pedestrian path opportunities are available		0		23680 ft 6-8 crossings		23680 ft 6-8 crossings		23680 ft 6-8 crossings	
	3	Park Land Impacts	Amount of land taken from parks for road (acres). This is a measure of the area of land taken from parks for the road improvements. The evaluation should consider the area taken related to the overall park area and the potential loss of amenities due to the loss of area.		0		5.53		6.35		6.58	
	4	Does the alternative improve or degrade the noise levels experienced by those adjacent to the corridor?	Noise levels as measured by traffic models (decibels average - based on average AM / PM TNM Lookup values.) Evaluation should consider where a change becomes noticeable, where it becomes painful and where it becomes damaging.		67.0		66.3 -1.0%		66.6 -0.6%		66.6 -0.6%	
	5	Does the alternative improve or degrade the air quality experienced by those adjacent to the corridor?	Air quality levels as measured by traffic models (Pounds of GHG emissions average - sum of AM / PM peak based on WSDOT corridor planning values.). Evaluation should consider where a change becomes noticeable, where it becomes unhealthy.		5,943,167		5,816,042 -2.1%		6,249,021 5.1%		6,213,590 4.5%	
Mobility	6	Does the alternative facilitate community access to Braddock Road?	Travel time for vehicles in the system to and from the neighborhoods (seconds per vehicle averaged over all trips.) This is an indication of how long it will take to get into and out of the neighborhoods adjacent to the study corridor.	4.7	167.21		86.1 -48.5%		111.35 -33.4%		69.82 -58.2%	
	7	Pedestrian/Bicycle travel time	Pedestrian/bicycle Travel time (minutes - for the entire network and critical movements for EB and WB traffic along Braddock Road). Lowering the pedestrian/bicycle travel time improves the desirability of the corridor for pedestrian and bicycle trips.		73.3		71.8 -2.1%		67.2 -8.3%		67.2 -8.3%	
	8	Will the alternative provide better access and circulation for pedestrians and bicycles, as represented by the number of broken path links restored?	Net change in the number of broken path links restored by the option (number). This is a measure of how the option provides connectivity of paths to and between the neighborhoods along the study corridor.		0		14		14		14	
Safety	9	Is it likely that existing conflict areas are improved?	Number of corridor-wide conflict points (number). This is a count of the number of conflict points along the corridor. A reduction in the number of conflict points is considered to improve safety.	4.7	597		510 -14.6%		480 -19.6%		480 -19.6%	
	10	Is it likely that the suggested improvements will lower or increase potential crashes?	Highway Safety Manual Computed Expected Crash Rate (crashes/year - current value 150.) This is a computation of the anticipated number of crashes along the corridor, based on the proposed characteristics of the corridor. An improvement is the reduction in the number of crashes computed.		345		275 -20.3%		253 -26.7%		253 -26.7%	
	11	Are safe movements provided for pedestrians and bicycles?	Number of signal-protected crossings and number of grade separated crossings. A higher number is considered better for pedestrian and bicycle access.		7 signal 1 grade sep		7 signal 2 grade sep		7 signal 2 grade sep		7 signal 2 grade sep	
Transportation Network Efficiency	12	Option that creates the least aggregate travel time	Vehicular travel time (minutes per vehicle). Lowering the travel time improves network traffic flow as well as travel time within the community.	2.6	17.10		10.76 -37.1%		11.1 -35.1%		11.23 -34.3%	
	13	Travel time represented by critical movements	Average Travel time (minutes - Average of EB / WB travel time and average of AM / PM peak values.) Lowering the travel time improves person throughput through the corridor.		20.3		13.3 -34.5%		13.1 -35.5%		13.4 -34.0%	
	14	Does the alternative facilitate traffic through the corridor?	Person throughput (number of person trips processed through the corridor - sum of AM and PM peaks.) This is a measure of how well the option processes person trips through the network.		18,840		22,326 18.5%		23,988 27.3%		23,851 26.6%	
ROW Impacts	15	Total area of right-of-way taken (fee R/W - acres)	Area of right-of-way taken (acres). Total area of right-of-way taken is land permanently taken from the adjacent property for the corridor improvements. The area taken does not necessarily mean that the use of the properties impacted is reduced in any way.	3	0.00		9.69		12.72		12.94	
	16	Number of parcels impacted (including temporary and permanent easements)	Number of impacted parcels (each). This is the total number of parcels where some sort of right-of-way or easements will be required, based on the conceptual plans developed.		0		46		50		50	

Scoring Key: Compared to the "No-Build" scenario, is this element for the subject alternative: Much Worse: -2, Worse: -1, No Change: 0, Better: 1, Much Better: 2

Table 6-2: Roadway MOEs and Blank Scores

What you care about/ MOE		Description of MOE	Performance Measures - Metrics	Task Force Weights	No-Build		Intersection Improvements		HOV2 Inside		General Use Lane Addition	
					Measure	Score	Measure	Score	Measure	Score	Measure	Score
Environment	1	Availability for screening or landscaping enhancements	Area available for tree planting minus area of tree removal (square feet). A negative number means that there is a net loss of plantable area.	4.5	0	0	-756,200	-1	-968,800	-2	-1,011,700	-2
	2	Will alternative provide additional opportunities for bike/ pedestrian travel?	Linear feet of additional paths and number of crosswalks, crosswalk signals or pedestrian overpasses (length in feet). Considering this project is intended to provide additional access by all travel modes, a positive number means more bike/pedestrian path opportunities are available		0	0	23680 ft 6-8 crossings	2	23680 ft 6-8 crossings	2	23680 ft 6-8 crossings	2
	3	Park Land Impacts	Amount of land taken from parks for road (acres). This is a measure of the area of land taken from parks for the road improvements. The evaluation should consider the area taken related to the overall park area and the potential loss of amenities due to the loss of area.		0	0	5.53	-2	6.35	-2	6.58	-2
	4	Does the alternative improve or degrade the noise levels experienced by those adjacent to the corridor?	Noise levels as measured by traffic models (decibels average - based on average AM / PM TNM Lookup values.) Evaluation should consider where a change becomes noticeable, where it becomes painful and where it becomes damaging.		67.0	0	66.3 -1.0%	0	66.6 -0.6%	0	66.6 -0.6%	0
	5	Does the alternative improve or degrade the air quality experienced by those adjacent to the corridor?	Air quality levels as measured by traffic models (Pounds of GHG emissions average - sum of AM / PM peak based on WSDOT corridor planning values.). Evaluation should consider where a change becomes noticeable, where it becomes unhealthy.		5,943,167	0	5,816,042 -2.1%	1	6,249,021 5.1%	-1	6,213,590 4.5%	-1
Mobility	6	Does the alternative facilitate community access to Braddock Road?	Travel time for vehicles in the system to and from the neighborhoods (seconds per vehicle averaged over all trips.) This is an indication of how long it will take to get into and out of the neighborhoods adjacent to the study corridor.	4.7	167.21	0	86.1 -48.5%	2	111.35 -33.4%	1	69.82 -58.2%	2
	7	Pedestrian/Bicycle travel time	Pedestrian/bicycle Travel time (minutes - for the entire network and critical movements for EB and WB traffic along Braddock Road). Lowering the pedestrian/bicycle travel time improves the desirability of the corridor for pedestrian and bicycle trips.		73.3	0	71.8 -2.1%	0	67.2 -8.3%	1	67.2 -8.3%	1
	8	Will the alternative provide better access and circulation for pedestrians and bicycles, as represented by the number of broken path links restored?	Net change in the number of broken path links restored by the option (number). This is a measure of how the option provides connectivity of paths to and between the neighborhoods along the study corridor.		0	0	14	2	14	2	14	2
Safety	9	Is it likely that existing conflict areas are improved?	Number of corridor-wide conflict points (number). This is a count of the number of conflict points along the corridor. A reduction in the number of conflict points is considered to improve safety.	4.7	597	0	510 -14.6%	1	480 -19.6%	2	480 -19.6%	2
	10	Is it likely that the suggested improvements will lower or increase potential crashes?	Highway Safety Manual Computed Expected Crash Rate (crashes/year - current value 150.) This is a computation of the anticipated number of crashes along the corridor, based on the proposed characteristics of the corridor. An improvement is the reduction in the number of crashes computed.		345	0	275 -20.3%	1	253 -26.7%	2	253 -26.7%	2
	11	Are safe movements provided for pedestrians and bicycles?	Number of signal-protected crossings and number of grade separated crossings. A higher number is considered better for pedestrian and bicycle access.		7 signal 1 grade sep	0	7 signal 2 grade sep	1	7 signal 2 grade sep	1	7 signal 2 grade sep	1
Transportation Network Efficiency	12	Option that creates the least aggregate travel time	Vehicular travel time (minutes per vehicle). Lowering the travel time improves network traffic flow as well as travel time within the community.	2.6	17.10	0	10.76 -37.1%	2	11.1 -35.1%	2	11.23 -34.3%	2
	13	Travel time represented by critical movements	Average Travel time (minutes - Average of EB / WB travel time and average of AM / PM peak values.) Lowering the travel time improves person throughput through the corridor.		20.3	0	13.3 -34.5%	2	13.1 -35.5%	2	13.4 -34.0%	2
	14	Does the alternative facilitate traffic through the corridor?	Person throughput (number of person trips processed through the corridor - sum of AM and PM peaks.) This is a measure of how well the option processes person trips through the network.		18,840	0	22,326 18.5%	1	23,988 27.3%	2	23,851 26.6%	2
ROW Impacts	15	Total area of right-of-way taken (fee R/W - acres)	Area of right-of-way taken (acres). Total area of right-of-way taken is land permanently taken from the adjacent property for the corridor improvements. The area taken does not necessarily mean that the use of the properties impacted is reduced in any way.	3	0.00	0	9.69	-1	12.72	-2	12.94	-2
	16	Number of parcels impacted (including temporary and permanent easements)	Number of impacted parcels (each). This is the total number of parcels where some sort of right-of-way or easements will be required, based on the conceptual plans developed.		0	0	46	-1	50	-2	50	-2
Scoring Key:		Compared to the "No-Build" scenario, is this element for the subject alternative:	Much Worse: -2, Worse: -1, No Change: 0, Better: 1, Much Better: 2	SCORES:	0.00		12.30		10.60		12.17	

Table 6-4: Technical Team MOE Scoring

What you care about/ MOE		Description of MOE	Performance Measures - Metrics	Task Force Weights	No-Build		Intersection Improvements		HOV2 Inside		General Use Lane Addition	
					Measure	Score	Measure	Score	Measure	Score	Measure	Score
Environment	1	Availability for screening or landscaping enhancements	Area available for tree planting minus area of tree removal (square feet). A negative number means that there is a net loss of plantable area.	4.5	0	0	-756,200	-1.5	-968,800	-2	-1,011,700	-2
	2	Will alternative provide additional opportunities for bike/ pedestrian travel?	Linear feet of additional paths and number of crosswalks, crosswalk signals or pedestrian overpasses (length in feet). Considering this project is intended to provide additional access by all travel modes, a positive number means more bike/pedestrian path opportunities are available		0	0	23680 ft 6-8 crossings	1.25	23680 ft 6-8 crossings	1	23680 ft 6-8 crossings	1
	3	Park Land Impacts	Amount of land taken from parks for road (acres). This is a measure of the area of land taken from parks for the road improvements. The evaluation should consider the area taken related to the overall park area and the potential loss of amenities due to the loss of area.		0	0	5.53	-2	6.35	-2	6.58	-2
	4	Does the alternative improve or degrade the noise levels experienced by those adjacent to the corridor?	Noise levels as measured by traffic models (decibels average - based on average AM / PM TNM Lookup values.) Evaluation should consider where a change becomes noticeable, where it becomes painful and where it becomes damaging.		67.0	0	66.3 -1.0%	0	66.6 -0.6%	-1	66.6 -0.6%	-1
	5	Does the alternative improve or degrade the air quality experienced by those adjacent to the corridor?	Air quality levels as measured by traffic models (Pounds of GHG emissions average - sum of AM / PM peak based on WSDOT corridor planning values.). Evaluation should consider where a change becomes noticeable, where it becomes unhealthy.		5,943,167	0	5,816,042 -2.1%	0.5	6,249,021 5.1%	-1	6,213,590 4.5%	-1
Mobility	6	Does the alternative facilitate community access to Braddock Road?	Travel time for vehicles in the system to and from the neighborhoods (seconds per vehicle averaged over all trips.) This is an indication of how long it will take to get into and out of the neighborhoods adjacent to the study corridor.	4.7	167.21	0	86.1 -48.5%	1	111.35 -33.4%	-1	69.82 -58.2%	1
	7	Pedestrian/Bicycle travel time	Pedestrian/bicycle Travel time (minutes - for the entire network and critical movements for EB and WB traffic along Braddock Road). Lowering the pedestrian/bicycle travel time improves the desirability of the corridor for pedestrian and bicycle trips.		73.3	0	71.8 -2.1%	0	67.2 -8.3%	0	67.2 -8.3%	0
	8	Will the alternative provide better access and circulation for pedestrians and bicycles, as represented by the number of broken path links restored?	Net change in the number of broken path links restored by the option (number). This is a measure of how the option provides connectivity of paths to and between the neighborhoods along the study corridor.		0	0	14	2	14	2	14	2
Safety	9	Is it likely that existing conflict areas are improved?	Number of corridor-wide conflict points (number). This is a count of the number of conflict points along the corridor. A reduction in the number of conflict points is considered to improve safety.	4.7	597	0	510 -14.6%	1	480 -19.6%	1.25	480 -19.6%	1.75
	10	Is it likely that the suggested improvements will lower or increase potential crashes?	Highway Safety Manual Computed Expected Crash Rate (crashes/year - current value 150.) This is a computation of the anticipated number of crashes along the corridor, based on the proposed characteristics of the corridor. An improvement is the reduction in the number of crashes computed.		345	0	275 -20.3%	1	253 -26.7%	1	253 -26.7%	1
	11	Are safe movements provided for pedestrians and bicycles?	Number of signal-protected crossings and number of grade separated crossings. A higher number is considered better for pedestrian and bicycle access.		7 signal 1 grade sep	0	7 signal 2 grade sep	1	7 signal 2 grade sep	1	7 signal 2 grade sep	1
Transportation Network Efficiency	12	Option that creates the least aggregate travel time	Vehicular travel time (minutes per vehicle). Lowering the travel time improves network traffic flow as well as travel time within the community.	2.6	17.10	0	10.76 -37.1%	2	11.1 -35.1%	1	11.23 -34.3%	2
	13	Travel time represented by critical movements	Average Travel time (minutes - Average of EB / WB travel time and average of AM / PM peak values.) Lowering the travel time improves person throughput through the corridor.		20.3	0	13.3 -34.5%	2	13.1 -35.5%	1	13.4 -34.0%	2
	14	Does the alternative facilitate traffic through the corridor?	Person throughput (number of person trips processed through the corridor - sum of AM and PM peaks.) This is a measure of how well the option processes person trips through the network.		18,840	0	22,326 18.5%	1	23,988 27.3%	1.5	23,851 26.6%	1.5
ROW Impacts	15	Total area of right-of-way taken (fee R/W - acres)	Area of right-of-way taken (acres). Total area of right-of-way taken is land permanently taken from the adjacent property for the corridor improvements. The area taken does not necessarily mean that the use of the properties impacted is reduced in any way.	3	0.00	0	9.69	-1.5	12.72	-2	12.94	-2
	16	Number of parcels impacted (including temporary and permanent easements)	Number of impacted parcels (each). This is the total number of parcels where some sort of right-of-way or easements will be required, based on the conceptual plans developed.		0	0	46	-1	50	-2	50	-2
Scoring Key:		Compared to the "No-Build" scenario, is this element for the subject alternative:	Much Worse: -2, Worse: -1, No Change: 0, Better: 1, Much Better: 2	**SCORES:**	**0.00**		**8.41**		**-0.81**		**4.84**	

Table 6-5: Task Force MOE Scoring

Chapter 7: Park-&-Ride Lot and Transit Center

The Braddock Road Multimodal Study included studying various locations along the study corridor for a transit center, developing transit center configurations for the various locations, and evaluating the locations/configurations. The vetting process included developing Measurements of Effectiveness (MOE) and calculating scores for the MOEs from both the technical team and the Task Force. A park-&-ride configuration was later included in the study at the Kings Park Shopping Center location, as an alternative to a transit center. **Figure 7-1** below shows locations studied as possible transit center locations (yellow shading). During the course of the study, the two viable locations chosen for further detailed study included the Northern Virginia Training Center and the Kings Park Shopping Center.

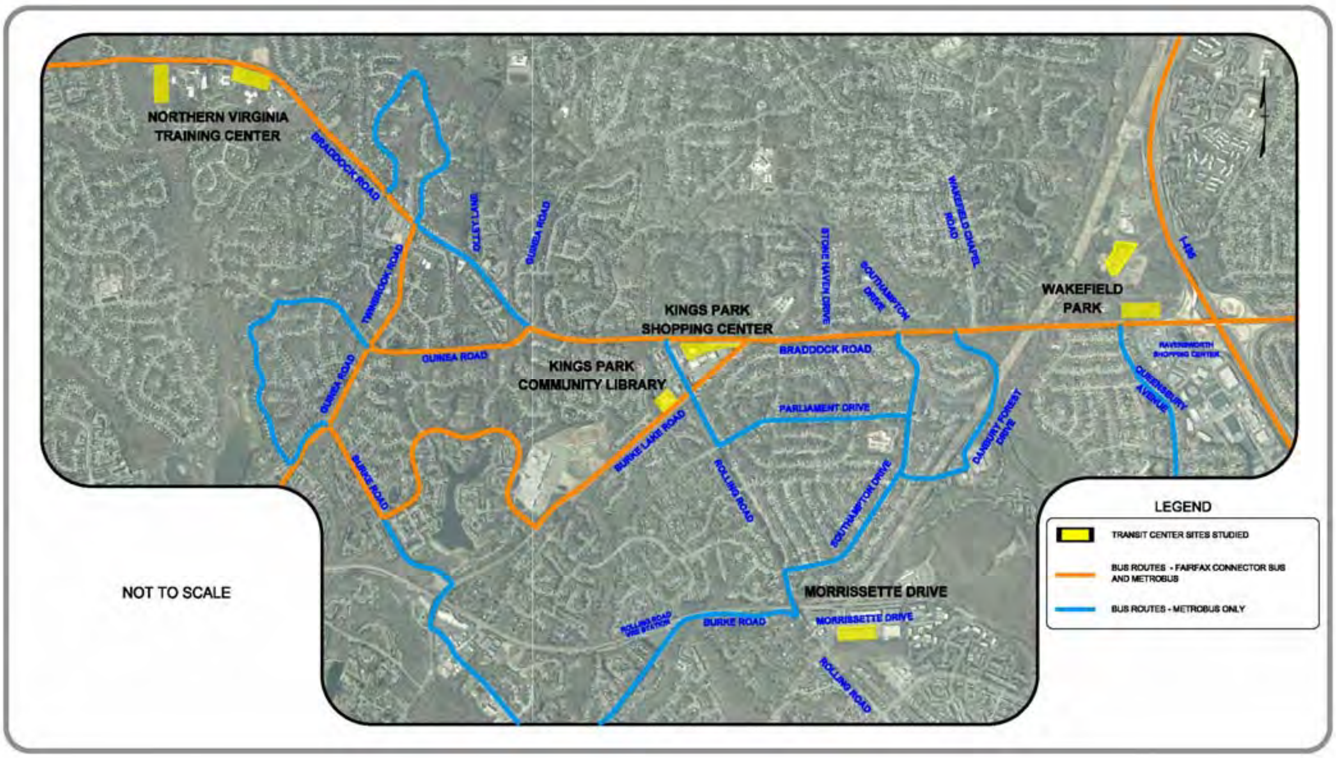


Figure 7-1: Transit Center Locations Studied

A. Locations Studied

i. Northern Virginia Training Center (East and West Locations)
The Northern Virginia Training Center was studied as a possible transit center location due to the large amount of land available and the direct access to the Braddock Road corridor. This location was chosen for consideration and further study.

ii. Kings Park Community Library
The Kings Park Community Library was studied as a possible transit center location because of the number of routes that would be served by the transit center, County owned land, and proximity to Braddock Road. This site would require a parking structure due to the limited land available and possibly a new structure for the library. This location was dropped from consideration due to the smaller size of the land available for a transit center and its close proximity to single family housing.

iii. Kings Park Shopping Center

The Kings Park Shopping Center was studied as a possible transit center location because of the number of routes that would be served by the transit center, close proximity to shopping center, available open space, and direct connection to the Braddock Road corridor. This location as chosen for consideration and further study.

iv. Wakefield Park

Wakefield Park was studied as a possible transit center location because of the available land, limited residential properties in the surrounding area, and direct connection to the Braddock Road corridor. This location was dropped from consideration due to the impact on park land and the significant tree impact from one of the transit center layouts. The Task Force was also concerned that this site is located too close to I-495 to help with the traffic congestion along the Braddock Road corridor.

v. Morrissette Drive

The Morrissette Drive development was studied as a possible transit center location because of the limited residential properties in the surrounding area and per the request of the Task Force. This location was dropped from consideration due to its distance from the Braddock Road corridor and the limited ability to reroute buses to the site.

B. Proposed Locations

As part of a collaborative effort between FCDOT, the Braddock District Supervisor's Office and the Task Force the viable locations chosen for consideration and further study includes the Northern Virginia Training Center (West Location) and Kings Park Shopping Center (park-&-ride and transit center options). See Appendix F for the to date example layouts for each of the chosen options. NOTE: these layouts are only examples and are subject to change during the design stage.

C. Impacts

i. Property

a. Northern Virginia Training Center (West)

For the proposed transit center configuration there are no structural impacts anticipated. As seen in the example transit center layout an existing residential parking lot would need to be reconfigured.

b. Kings Park Shopping Center

For both the park-&-ride and transit center options at the Kings Park Shopping Center one structural impact is anticipated. The three story office building located in the shopping center would need to be demolished.

ii. Environmental

a. Northern Virginia Training Center (West)

The environmental impact for the training center location is the tree and vegetation impacts. Approximately 163,200 sq.ft. of trees/vegetation will need to be removed based on the most recent layout.

b. Kings Park Shopping Center

The environmental impact for the shopping center location is also the tree and vegetation impacts. Approximately 29,300 sq.ft. of trees/vegetation will need to be removed for the transit center option example and approximately 47,400 sq.ft. of trees/vegetation will need to be removed for the park-&-ride option example. There is a larger impact for The park-&-ride option because it includes surface parking and the transit center option includes a parking garage.

iii. Traffic

A transit center was only evaluated in VISSIM tied to the General Purpose Lanes Widening alternative. The study included VISSIM models that have a General Purpose Lanes Widening (no transit center) and a General Purpose Lanes Widening (with Transit Center); but separate travel demand model runs were not conducted. The VISSIM OD data was manipulated to reflect the addition of the transit center. The Future Year Build Traffic Analysis section of this report, Chapter 5, discusses the results. A transit center at Kings Park Shopping Center had no bearing on the travel time along Braddock Road. The results for the General Purpose Lanes Widening alternative VISSIM runs (1) without and (2) with the Transit Center can be found in Appendix L.

Note: Parking demand studies for the Park-&-Ride and Transit Centers are located in Appendix Q.

D. Cost Estimates

One aspect of the vetting process included comparing the estimated cost for each of the park-&-ride/transit center options. A conceptual level cost estimate was developed for each of the options that includes construction and right-of-way costs.

- Northern Virginia Training Center: Transit Center $10.73 Million
- Kings Park Shopping Center: Park-&-Ride $9.92 Million
- Kings Park Shopping Center: Transit Center $22.97 Million

The Kings Park Shopping Center: transit center option has a higher cost due to the proposed parking garage that would be a part of the option.

See Appendix G for the detailed conceptual level cost estimates.

E. Park-&-Ride Lot and Transit Center Measurements of Effectiveness (MOE)

i. Development of MOEs

The MOEs for the park-&-ride and transit center options were developed in coordination with the County staff and the Task Force. **Table 7-1** presents the final MOEs and the performance measures for each of the MOEs.

What you care about/ MOE		Description of MOE	Performance Measures - Metrics
Environment	1	Number of trees affected and loss of green space	Area of vegetation that needs to be removed to construct and maintain the facility (square feet)
	2	Does the alternative increase air pollution?	Aggregate Air Quality levels (NOx levels). Air quality levels as measured by traffic models (Pounds of GHG emissions average[1]). Evaluation should consider where a change becomes noticeable, where it becomes unhealthy.
	3	Will site lighting impact adjacent lands in a negative way?	Degree separation/screening between transit site and adjacent single-family properties, as measured by the number of residences within ¼ mile of the site
Mobility	4	Ease of access in/out for commuter vehicles	Number of entrances (number). Are the accesses configured in a way to facilitate commuter access into and out of the site?
	5	Ease and convenience of access for pedestrians & bicycles	Number of signalized pedestrian crossings or grade separations to site (number). Are the proposed crossings safe as compared to the existing crossings?
	6	Increase in the number of traffic signals	Number added (positive) or removed (negative) as a result of the proposal. This could be anywhere on the corridor, except as already planned for by roadway improvements.
	7	Ease of access for transit routes	Number of drive entrances and signals for left-turn movements (number). Are the accesses configured in a way to facilitate transit access into and out of the site?
Safety	8	Will vehicular access in/out of facility be safe?	Number of conflict points at entrances (number). This is a measure of the number of points where vehicles cross paths. More conflict points generally relate to a lower safety score.
	9	Are safe movements provided to pedestrians and bicycles?	Number of pedestrian/bicycle conflict points **with vehicles** over a typical path. This is a measure of the number of points where vehicles paths intersect crosswalks. More conflict points generally relate to a lower safety score.
Roadway Travel Time	10	Braddock Road vehicle travel time	Travel time along Braddock Road from Guinea Road to I-495, as it is impacted by movements into and out of transit center (minutes). Lower travel time is considered to be better as the transit center traffic is improving traffic flow.
	11	Person throughput through the corridor	Sum of AM and PM peaks – same as widening study. Increase or decrease must exceed 5% of No Transit Center option to be deemed significant.
	12	Increase in vehicular density at major intersections	Adjacent Intersections. A lower number is better. (seconds/vehicle) **

Table 7-1: MOEs and Performance Measures

After completing the development of the MOEs the Task Force developed a scoring weight for each of the major MOE categories (categories located in the far left column of **Table 7-1** above). The weight for each category: Environment: 0.5, Mobility: 1.5, Safety: 3.0, and Roadway Travel Time: 5.0. Performance measure scoring under each MOE category were averaged and then multiplied by these weights, see **Table 7-2** (Blank Scores, see next page).

ii. Evaluations

The Technical Team included both County staff and RK&K staff. **Table 7-3** below is a summary of the scores from the Technical Team and Task Force. **Figure 7-4** presents the MOE scoring from the Technical Team. **Figure 7-5** presents the MOE scoring from the Task Force.

Options	Technical Team	Task Force
NOVA Training Center (West) Transit Center	-0.35	**-0.81**
Kings Park Shopping Center Park-&-Ride	0.88	-2.75
Kings Park Shopping Center Transit Center	**1.02**	-3.21

Table 7-3: Scoring Summary

What you care about/ MOE		Description of MOE	Performance Measures - Metrics	Task Force Weights*	No Transit Center		Transit Center Options: Kings Park Shopping Center Garage		Transit Center Options: NOVA Training Center West Site		Kings Park Shopping Center Park-and-Ride	
					Measure	Score	Measure	Score	Measure	Score	Measure	Score
Environment	1	Number of trees affected and loss of green space	Area of vegetation that needs to be removed to construct and maintain the facility (square feet)	0.5	0	0	29,300		163,200		47,400	
Environment	2	Does the alternative increase air pollution?	Aggregate Air Quality levels (NOx levels). Air quality levels as measured by traffic models (Pounds of GHG emissions average[1]). Evaluation should consider where a change becomes noticeable, where it becomes unhealthy.	0.5	5,816,042	0	5,688,754 (-2.2%)		5,706,311 (-1.9%)		5,688,754 (-2.2%)	
Environment	3	Will site lighting impact adjacent lands in a negative way?	Degree separation/screening between transit site and adjacent single-family properties, as measured by the number of residences within ¼ mile of the site	0.5	0	0	194		119		194	
Mobility	4	Ease of access in/out for commuter vehicles	Number of entrances (number). Are the accesses configured in a way to facilitate commuter access into and out of the site?	1.5	N/A	0	2		2		3	
Mobility	5	Ease and convenience of access for pedestrians & bicycles	Number of signalized pedestrian crossings or grade separations to site (number). Are the proposed crossings safe as compared to the existing crossings?	1.5	N/A	0	1		0		1	
Mobility	6	Increase in the number of traffic signals	Number added (positive) or removed (negative) as a result of the proposal. This could be anywhere on the corridor, except as already planned for by roadway improvements.	1.5	0	0	(+)1		0		(+)1	
Mobility	7	Ease of access for transit routes	Number of drive entrances and signals for left-turn movements (number). Are the accesses configured in a way to facilitate transit access into and out of the site?	1.5	N/A	0	2 Entrances 1 Signal		2 Entrances 1 existing signal for exiting only		Buses do not enter site	
Safety	8	Will vehicular access in/out of facility be safe?	Number of conflict points at entrances (number). This is a measure of the number of points where vehicles cross paths. More conflict points generally relate to a lower safety score.	3.0	N/A	0	74		52		78	
Safety	9	Are safe movements provided to pedestrians and bicycles?	Number of pedestrian/bicycle conflict points **with vehicles** over a typical path. This is a measure of the number of points where vehicles paths intersect crosswalks. More conflict points generally relate to a lower safety score.	3.0	N/A	0	6		6		8	
Roadway Travel Time	10	Braddock Road vehicle travel time	Travel time along Braddock Road from Guinea Road to I-495, as it is impacted by movements into and out of transit center (minutes). Lower travel time is considered to be better as the transit center traffic is improving traffic flow.	5.0	13.3	0	11.9 (-10.5%)		12.5 (-6.0%)		11.6 (-12.8%)	
Roadway Travel Time	11	Person throughput through the corridor	Sum of AM and PM peaks – same as widening study. Increase or decrease must exceed 5% of No Transit Center option to be deemed significant.	5.0	22,326	0	23,851 (+6.8%)		22,629 (+1.4%)		23,468 (+5.1%)	
Roadway Travel Time	12	Increase in vehicular density at major intersections	Adjacent Intersections. A lower number is better. (seconds/vehicle) **	5.0	84 (KPSC) 49 (NOVA)	0	110 (+31.0%)		52 (+6.1%)		106 (+26.2%)	

Scoring Key: Compared to the "No Transit Center" scenario, is this element for the subject alternative: Much Worse: -2, Worse: -1, No Change: 0, Better: 1, Much Better: 2

SCORES: ______ ______ ______ ______

*** Final weight factors determined by the Task Force on April 5, 2017. Performance measure weights under each MOE category are averaged and then multiplied by this weighting.**

**** Average of overall intersection delay for AM and PM peak (At Kings Park: Rolling/Burke Lake, Braddock/Rolling, Braddock/Burke Lake, Rolling/Kings Park Shopping Center); (At NOVA Training Center: Braddock / Burke Station)**

[1] Sum of AM / PM peak based on WSDOT corridor planning values

Table 7-2: Transit Center MOEs and Blank Scores

What you care about/ MOE		Description of MOE	Performance Measures - Metrics	Task Force Weights*	No Transit Center		Transit Center Options: Kings Park Shopping Center Garage		Transit Center Options: NOVA Training Center West Site		Kings Park Shopping Center Park-and-Ride	
					Measure	Score	Measure	Score	Measure	Score	Measure	Score
Environment	1	Number of trees affected and loss of green space	Area of vegetation that needs to be removed to construct and maintain the facility (square feet)	0.5	0	0	29,300	-0.5	163,200	-2	47,400	-0.5
	2	Does the alternative increase air pollution?	Aggregate Air Quality levels (NOx levels). Air quality levels as measured by traffic models (Pounds of GHG emissions average[1]). Evaluation should consider where a change becomes noticeable, where it becomes unhealthy.		5,816,042	0	5,688,754 (-2.2%)	1	5,706,311 (-1.9%)	1	5,688,754 (-2.2%)	1
	3	Will site lighting impact adjacent lands in a negative way?	Degree separation/screening between transit site and adjacent single-family properties, as measured by the number of residences within ¼ mile of the site		0	0	194	-1	119	-0.5	194	-1
Mobility	4	Ease of access in/out for commuter vehicles	Number of entrances (number). Are the accesses configured in a way to facilitate commuter access into and out of the site?	1.5	N/A	0	2	1	2	1	3	1.5
	5	Ease and convenience of access for pedestrians & bicycles	Number of signalized pedestrian crossings or grade separations to site (number). Are the proposed crossings safe as compared to the existing crossings?		N/A	0	1	2	0	0	1	2
	6	Increase in the number of traffic signals	Number added (positive) or removed (negative) as a result of the proposal. This could be anywhere on the corridor, except as already planned for by roadway improvements.		0	0	(+)1	0.5	0	0	(+)1	0.5
	7	Ease of access for transit routes	Number of drive entrances and signals for left-turn movements (number). Are the accesses configured in a way to facilitate transit access into and out of the site?		N/A	0	2 Entrances 1 Signal	1	2 Entrances 1 existing signal for exiting only	0.5	Buses do not enter site	0
Safety	8	Will vehicular access in/out of facility be safe?	Number of conflict points at entrances (number). This is a measure of the number of points where vehicles cross paths. More conflict points generally relate to a lower safety score.	3.0	N/A	0	74	-1	52	-0.5	78	-1
	9	Are safe movements provided to pedestrians and bicycles?	Number of pedestrian/bicycle conflict points **with vehicles** over a typical path. This is a measure of the number of points where vehicles paths intersect crosswalks. More conflict points generally relate to a lower safety score.		N/A	0	6	-0.5	6	-0.5	8	-0.75
Roadway Travel Time	10	Braddock Road vehicle travel time	Travel time along Braddock Road from Guinea Road to I-495, as it is impacted by movements into and out of transit center (minutes). Lower travel time is considered to be better as the transit center traffic is improving traffic flow.	5.0	13.3	0	11.9 (-10.5%)	1	12.5 (-6.0%)	0.5	11.6 (-12.8%)	1.25
	11	Person throughput through the corridor	Sum of AM and PM peaks – same as widening study. Increase or decrease must exceed 5% of No Transit Center option to be deemed significant.		22,326	0	23,851 (+6.8%)	1.5	22,629 (+1.4%)	0.5	23,468 (+5.1%)	1.5
	12	Increase in vehicular density at major intersections	Adjacent Intersections. A lower number is better. (seconds/vehicle) **		84 (KPSC) 49 (NOVA)	0	110 (+31.0%)	-1.5	52 (+6.1%)	-0.5	106 (+26.2%)	-1.5
Scoring Key:		Compared to the "No Transit Center" scenario, is this element for the subject alternative:	Much Worse: -2, Worse: -1, No Change: 0, Better: 1, Much Better: 2	SCORES:	0.00		1.02		-0.35		0.88	

*** Final weight factors determined by the Task Force on April 5, 2017. Performance measure weights under each MOE category are averaged and then multiplied by this weighting.**

**** Average of overall intersection delay for AM and PM peak (At Kings Park: Rolling/Burke Lake, Braddock/Rolling, Braddock/Burke Lake, Rolling/Kings Park Shopping Center); (At NOVA Training Center: Braddock / Burke Station)**

[1] Sum of AM / PM peak based on WSDOT corridor planning values

Table 7-4: Technical Team MOE Scoring

What you care about/ MOE		Description of MOE	Performance Measures - Metrics	Task Force Weights*	No Transit Center		Transit Center Options				Kings Park Shopping Center Park-and-Ride	
							Kings Park Shopping Center Garage		NOVA Training Center West Site			
					Measure	Score	Measure	Score	Measure	Score	Measure	Score
Environment	1	Number of trees affected and loss of green space	Area of vegetation that needs to be removed to construct and maintain the facility (square feet)	0.5	0	0	29,300	-0.5	163,200	-2	47,400	-0.5
	2	Does the alternative increase air pollution?	Aggregate Air Quality levels (NOx levels). Air quality levels as measured by traffic models (Pounds of GHG emissions average[1]). Evaluation should consider where a change becomes noticeable, where it becomes unhealthy.		5,816,042	0	5,688,754 (-2.2%)	0.5	5,706,311 (-1.9%)	0.5	5,688,754 (-2.2%)	0.5
	3	Will site lighting impact adjacent lands in a negative way?	Degree separation/screening between transit site and adjacent single-family properties, as measured by the number of residences within ¼ mile of the site		0	0	194	-1	119	-0.5	194	-1
Mobility	4	Ease of access in/out for commuter vehicles	Number of entrances (number). Are the accesses configured in a way to facilitate commuter access into and out of the site?	1.5	N/A	0	2	0	2	0	3	1
	5	Ease and convenience of access for pedestrians & bicycles	Number of signalized pedestrian crossings or grade separations to site (number). Are the proposed crossings safe as compared to the existing crossings?		N/A	0	1	1	0	0	1	1
	6	Increase in the number of traffic signals	Number added (positive) or removed (negative) as a result of the proposal. This could be anywhere on the corridor, except as already planned for by roadway improvements.		0	0	(+)1	-1	0	0	(+)1	-1
	7	Ease of access for transit routes	Number of drive entrances and signals for left-turn movements (number). Are the accesses configured in a way to facilitate transit access into and out of the site?		N/A	0	2 Entrances 1 Signal	1	2 Entrances 1 existing signal for exiting only	0.5	Buses do not enter site	0
Safety	8	Will vehicular access in/out of facility be safe?	Number of conflict points at entrances (number). This is a measure of the number of points where vehicles cross paths. More conflict points generally relate to a lower safety score.	3.0	N/A	0	74	-1.5	52	-0.5	78	-1.5
	9	Are safe movements provided to pedestrians and bicycles?	Number of pedestrian/bicycle conflict points **with vehicles** over a typical path. This is a measure of the number of points where vehicles paths intersect crosswalks. More conflict points generally relate to a lower safety score.		N/A	0	6	-0.5	6	-0.5	8	-0.75
Roadway Travel Time	10	Braddock Road vehicle travel time	Travel time along Braddock Road from Guinea Road to I-495, as it is impacted by movements into and out of transit center (minutes). Lower travel time is considered to be better as the transit center traffic is improving traffic flow.	5.0	13.3	0	11.9 (-10.5%)	1	12.5 (-6.0%)	0.5	11.6 (-12.8%)	1.25
	11	Person throughput through the corridor	Sum of AM and PM peaks – same as widening study. Increase or decrease must exceed 5% of No Transit Center option to be deemed significant.		22,326	0	23,851 (+6.8%)	0.75	22,629 (+1.4%)	0.5	23,468 (+5.1%)	0.75
	12	Increase in vehicular density at major intersections	Adjacent Intersections. A lower number is better. (seconds/vehicle) **		84 (KPSC) 49 (NOVA)	0	110 (+31.0%)	-2	52 (+6.1%)	-0.5	106 (+26.2%)	-1.75
Scoring Key:		Compared to the "No Transit Center" scenario, is this element for the subject alternative:	Much Worse: -2, Worse: -1, No Change: 0, Better: 1, Much Better: 2	**SCORES:**	**0.00**		**-3.21**		**-0.81**		**-2.75**	

*** Final weight factors determined by the Task Force on April 5, 2017. Performance measure weights under each MOE category are averaged and then multiplied by this weighting.**
**** Average of overall intersection delay for AM and PM peak (At Kings Park: Rolling/Burke Lake, Braddock/Rolling, Braddock/Burke Lake, Rolling/Kings Park Shopping Center); (At NOVA Training Center: Braddock / Burke Station)**

[1] Sum of AM / PM peak based on WSDOT corridor planning values

Table 7-5: Task Force MOE Scoring

Chapter 8: Public Outreach

Throughout the study, the study team (FCDOT and RK&K) met with various public/community groups to present the study (improvements) data, analysis, and recommendations along with addressing any public comments/concerns. The main public outreach took place at the four Community meetings held for the study. There were also numerous neighborhood/church meetings held to discuss the study and the impacts for that given neighborhood/church.

A. Community Meetings

i. Community Meeting #1 – June 9, 2015
The meeting goal was to introduce the study, roadway alternatives, and the transit center locations/layout examples.

ii. Community Meeting #2 – April 25, 2016
The meeting goal was to review the current roadway alternatives and park-&-ride/transit center options. The traffic modeling data was also presented and discussed. A dynamic traffic simulation for each roadway alternative (including no build) was presented at the meeting.

iii. Community Meeting #3 – February 6, 2017
The meeting goal was to review the Technical Team and Task Force recommendations for the Roadway Alternatives. The park-&-ride and transit center options were not discussed or presented.

iv. Community Meeting #4 – June 26, 2017
The meeting goal was to review the Technical Team and Task Force recommendations for the park-&-ride and transit center. The recommend roadway alternative, Intersection and Corridor Improvements alternative, was reiterated.

A Summary for each Community Meeting can be found in Appendix M. Documents and exhibits from each Community Meeting can be found in Appendix U.

B. Neighborhood and Church Meetings

i. Neighborhood Meetings – The following meetings were held to present and discuss the roadway alternatives and/or Transit Center options along with their impacts to the specific neighborhood community in attendance:
   a. Brook Hills – May 10, 2016 and February 15, 2017
   b. Olde Forge and Surrey Square – May 19, 2016
   c. The Elms – August 16, 2016 and November 16, 2016
   d. Canterbury Woods – May 16, 2017
   e. Red Fox Forest Civic Association – May 31, 2017

ii. Church Meetings – The following meetings were held to present and discuss the roadway alternatives and/or Transit Center options along with their impacts to the specific Church community in attendance:
   a. St. Stephens United Methodist Church, Holy Spirit Catholic Church and Parkwood Baptist Church – June 22, 2016

b. Parkwood Baptist Church – February 1, 2017
c. St. Stephens United Methodist Church – February 8, 2017

iii. Workshop/Open House Meetings – The following meetings were held to present and discuss the recommended roadway alternative, Intersection and Corridor Improvements alternative, along with the impacts to the specific community in attendance:
   a. At Braddock Hall – Focused on Guinea Road to Dunleigh-King David – September 18, 2017
   b. At Braddock Hall – Focused on Wakefield Chapel to Danbury Forest – October 2, 2017
   c. At Braddock Hall – Focused on Beltway Area – October 18, 2017
   d. At Kings Park Library – Focused on Burke Lake Intersection – October 25, 2017
   e. At Ravensworth Baptist Church – Focused on Ravensworth Road Intersection – November 16, 2017
   f. At Kings Park Library – Focused on Burke Lake Intersection – December 11, 2017

C. Public Surveys

i. Commuter Attitude Survey – Spring 2015: Implemented to understand how community members utilize the Braddock Road Corridor and to determine what they view as priorities for the corridor improvements. See Appendix N.

ii. Transportation Options for Braddock Road Corridor Survey – Summer 2017: Implemented to gauge the community support for a park-&-ride facility at the Kings Park Shopping Center, and additional transit along Braddock Road. See Appendix O.

Chapter 9: Recommendations and Next Steps

The main goal of the Braddock Road Multimodal Study included developing and evaluating various improvement options for the study corridor. Once the alternatives were developed and thoroughly vetted both the Technical Team (FCDOT Staff and RK&K Team) and Task Force provided recommendations for the roadway and Park-&-Ride/Transit Center. The recommendations are based the MOE evaluations, data from the analysis, and community feedback.

A. Conclusions/Recommendations

i. Technical Team

a. Roadway

Based the MOE scores and cost estimates, the Technical Team recommends the Intersection and Corridor Improvements alternative for the Braddock Road Corridor.

b. Park-&-Ride and Transit Center

Conclusions:

1. If a transit center is built, the Kings Park Shopping Center location is the best option compared to the Training Center site.
2. Based on staff's analysis of the MOE's and other factors, a park-and-ride lot is a reasonable alternative to a transit center at Kings Park Shopping Center.
3. If a transit center or park-and-ride are not constructed at this time, it is suggested that the Kings Park Shopping Center location be reconsidered in the future.

Recommendations:

1. Construct the Park-and-Ride Lot at the Kings Park Shopping Center site with the roadway improvements.
2. Reconsider a Transit Center at the Kings Park Shopping Center site in the future.

ii. Task Force

a. Roadway

Based the MOE scores and cost estimates, the Task Force recommends the Intersection and Corridor Improvements alternative for the Braddock Road Corridor.

b. Park-&-Ride and Transit Center

Based on an evaluation of the proposed transit center and park-and-ride lot alternatives, the Braddock Road Multimodal Study Task Force (Task Force) came to the following conclusions:

1. The Task Force is not opposed to a transit center at the Northern Virginia Training Center site.
2. The Task Force opposes a transit center at the Kings Park Shopping Center site. Any further consideration of a transit center at the Kings Park Shopping Center site should not occur until after the proposed roadway improvements are completed and the transit center can be evaluated based on actual data from the improved roadway network.
3. The Task Force does not support a park-and-ride lot at the Kings Park Shopping Center site at this time. The Task Force recommends that any further consideration of a park-and-ride lot at the Kings Park Shopping Center site be deferred until after the proposed roadway improvements are completed and the park-and-ride lot can be evaluated based on actual data from the improved roadway network.

iii. Final Recommendations

a. Roadway

Based on both the Technical Team and Taskforce recommendations along with the MOE evaluations, data from the analysis, community feedback, and cost estimates the Intersection and Corridor Improvements alternative is the recommended improvement alternative for the Braddock Road Corridor.

b. Park-&-Ride and Transit Center

Based on both the Technical Team and Taskforce recommendations along with the MOE evaluations, data from the analysis, community feedback (including a survey on the a potential park-&-ride at Kings Park Shopping Center), and cost estimates; a park-&-ride lot or transit center will not be included with the roadway improvements or pursued further at this time.

B. Next Steps

i. Present Final Recommendations to Board of Supervisors

a. Present both the Technical Team and Task Force recommendations for the Roadway and Park-&-Ride/Transit Center. Note: The recommendations were presented on November 21, 2017 and were endorsed by the Board of Supervisors.

ii. Fall Community Meetings/Workshops

a. Meet with various neighborhoods and church communities to review the recommendations and the impacts on the community. Note: Six meetings/workshops were held from September through December 2017.

iii. Initiate project implementation of recommended alternative

a. Issues/concerns to be considered during design:

1. Parkwood Baptist Church Access:
Due to the signal removal at the Kings Park Drive intersection, access to the church is being limited from its current configuration. Church members have expressed concerns with the proposed alternative routes, see Appendix T. Additional alternatives were studied but not approved by VDOT, see Appendix P. Discussions will continue through the design phase.
2. Woodland Way Access from Burke Lake Road:
Due to anticipated operational factors the recommended alternative could not provide direct access from Burke Lake Road Northbound to Woodland Way Northbound. Additional study might provide insight into an alternative intersection configuration and/or operation.
3. Access Management:
Community members expressed safety and operational concerns with the proposed alternative paths, including the use of U-turns, see Appendix T.
4. Port Royal Road Access from I-495:
Community members expressed concern with the re-routing of the I-495 Southbound exiting traffic destined for Port Royal Road. See Appendix T for proposed alternative routes. The ramp grades along the new route will also need to be studied.
5. Ravensworth Road improvements:
Community members from the Ravensworth Road corridor expressed their concern with the proposed improvements to Ravensworth Road and the additional traffic the improvements will attract to the corridor.
6. Heavy traffic entering the corridor from outside the study area:
At various Community and neighborhood meetings community members discussed their concern

with existing and future vehicles from the west (Prince William County and Manassas) affecting the Braddock Road corridor.

7. Additional Pedestrian overpass (bridge) locations:
   Along with the two additional locations, see Chapter 5 Section B, Fairfax County is open to any viable location with community support.
8. Updated VISSIM Model:
   Prior to VDOT Design Acceptance, an updated VISSIM model should be produced to account for the final condition. Between the final VISSIM models produced for this report and the end of the planning phase, minor additions were made to the concept. Due to their minimal impact on operations they were not incorporated into the final VISSIM models. Final VISSIM models should be completed prior to the completion of the analysis phase of final design.
9. Undergrounding Utilities:
   There is a narrow space for undergrounding utilities along Eastbound Braddock Road from Guinea Road to Bradfield Drive.
10. Proximity of the proposed Shared-use Path to the house on the corner of The Elms neighborhood (Bradfield Drive).
11. Throughout the study process, Community members stated repeated concern about the level of noise anticipated to be generated as a result of the project. It had been requested at multiple times throughout the process that noise abatement measures be considered. The County has stated that as necessary, these measures will be reviewed and identified during the final design process.
12. Accotink Bridge (Braddock Road crossing over the Accotink Creek) improvements or replacement
13. Bus stop locations and bus routes

Appendix: Table of Contents

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